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ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

PRESENTED by the AUTHOR.

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ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

BY C. FABER, M.D.,

Late Res. Med. Officer to the German Hospital, London.

SEA-VOYAGES as a therapeutic remedy, especially for consumption, are resorted to more and more every year by the medical profession of this country. On my return a short time ago from a voyage round the world I even heard of a project to fit out a ship exclusively for invalids, and take them to Australia and back again.

Out of the numbers of medical men who are sending patients to sea for their health, only a few have had the opportunity of personally acquainting themselves with the several conditions which constitute sea-life, and the mode of action of this undoubtedly powerful agent. So they can often have nothing but a vague notion of the *pros* and *cons* regarding the use of this remedy in a given case. But nothing certainly is more important for the successful treatment of a disease than a clear insight into the indications and contra-indications of the remedies used. With regard to sea-voyages, a knowledge of the contra-indications is especially needful, for in their case I have seen that want of accurate judgment which is the necessary consequence of want of accurate knowledge of the remedy and the mode of its action, followed by unusually sad consequences. Imagine a patient torn away, by medical orders, from his family and friends, and all the home comforts doubly dear to an invalid, sent away on a sea-voyage to the antipodes, which, instead of restoring him to a state of comparative health and renewed strength, only hastens his death. How much milder would the pangs of death have been, how much easier the parting from life, had he been allowed to die at home, instead of many thousand miles away on the solitary ocean, in the small, cheerless cabin of a ship!

So the question put to the medical adviser is a double one, involving not only a consideration of the patient's recovery, but also one of sheer humanity. The answer to the question will be in a great measure right or wrong, according to the medical man's correct knowledge of the remedy or his want of it. A careful and accurate judgment is all the more important here, because by the very use of this remedy the physician loses all control over his patient for many months together, and because the remedy cannot be discontinued like any other, in case it turns out injurious instead of beneficial. For to believe that sea-life *must* prove beneficial to everybody is a dangerous fallacy.

My own experience, on which these papers are based, is taken from two long sea-voyages I have made as a medical officer, the first one of over three months and a half, to South America in a mail steamer; the second, of eight months and a half, round the world *viâ* Australia in a sailing vessel. The route to Australia and back is of all others the one most patronised by the medical profession of this country, and therefore most frequented by invalids. In fact, my last ship was full of them, and resembled a regular hospital ship for consumptive patients. As I myself do not expect to get any more medico-nautical experience, and as on the other hand those medical men who are regularly "trading" between this country and Australia appear to be very chary of communicating their more prolonged experience in this way for the common use of the profession and of the class of patients concerned, I may be justified in bringing forward a subject which certainly is not wanting in scientific, as well as practical interest.

I have been endeavouring to extend my observations to every point bearing upon the question of the influence of sea-voyages on the human body, and especially on consumption, as the following list of contents of the different papers in which I intend to deal with it may show.

I. *On sea-climate.*—Sea-climate in general, and the climate of the different oceans and latitudes in particular, as shown by my meteorological journal, where the general state of the weather, the maximum and minimum temperatures, the readings of the barometer, rainfall, direction and strength of the wind, etc., are noted for every day.

II. *On sea-life in its sanitary aspects* for sailors and for passengers, especially for invalids.

III. *On the influence of different climates and of sea-life on the temperature of the body, the pulse, and respiration.*—The results I have arrived at in this interesting question, based upon tables extending over a range of nearly 110° of latitude, and of 360° of longitude, will be found in a good many points materially to differ from and to add to former observations.

IV. *On the physiology and pathology of sea-life,* i.e., in what way the functions of the human body are influenced within and beyond the limits of health, what the prevailing diseases and ailments at sea are, and how far the usual course and signs of diseases are influenced or modified by sea-life, as shown by an analysis of my medical journals.

Sea-sickness is treated in a separate paper.

V. *On the climatic treatment of consumption* in general, and in particular on the question, whether to send a patient on a long sea-voyage or not.

VI. *On the choice of the sea-routes and of the vessel* (steamer or sailing vessel) best suited for a therapeutical purpose, with practical hints regarding the outfit of an invalid, the accommodation and the life on board.

VII. *On the climate, the sanitary conditions and institutions of Australia and Tasmania;* with practical advice to invalids, how long and where to stay or not, and how to live on land.

I.—ON SEA-CLIMATE.

The details, and especially the figures I am going to give in this paper, may appear very dry and trying to read, yet I daresay that he who is sending patients to sea, or who is himself going on a long sea-voyage for his health, will find them of great practical importance. Before, however, going into details, it may not be superfluous shortly to speak of sea-climate in general, and to point out the difference between land- and sea-climate as far as it bears upon our subject. Of the different components which constitute that *ensemble* we call climate, some have very much the same value at sea as on land, *e.g.*, the temperature of the air and the pressure of the atmosphere; whilst others have a peculiar significance at sea. The wind, its direction, and strength is not only an all-important element to the sailor, but also to the invalid seeking health on the ocean. Here it is not impeded or diverted by any visible obstacle which might give shelter; it sweeps free over ocean and ship, chilling or bracing, cooling or scorching, as the case may be. If it is saturated with moisture, there are no mountain-ranges to condense that moisture into rain, so as to dry the air beyond them. On the contrary, if the wind is of some strength it will raise the surface of the sea into billows, the white crests of which send a briny spray over the deck, and at any rate in a purely mechanical way saturate the air on deck with salt-water, even when this is not visible. Too much stress has, in my opinion, often been laid on this circumstance with regard to the therapeutical action of the sea-air. Apart from the moisture raised by mechanical force, that raised by way of evaporation may *à priori* be expected to be, on the whole, larger in amount at sea than on land. This fact appeals to the senses most forcibly under a tropical sun, if there is no wind to relieve the distressing effects of the heat and dampness combined.

Of great moment to animal and vegetable life is the transparency of the air, and in connection with it the *intensity of light*. On the bright, sunny shores of the Mediterranean, many an invalid has regained his health and vigour. In the Alps, high up towards the limit of vegetation, one is surprised to find an abundance of flowers of the brightest hues; although the mean temperature in those heights must necessarily be low. High temperature and intensity of light are not by any means necessarily associated; they may be quite independent of one another. In the tropics, however, they are combined. Here in most places not only high temperature, but also great transparency of the air and intensity of light obtains. The sky seems to be higher, the stars seem remoter and of a mild planetary lustre. Also at sea, especially within the trade winds, one has an opportunity of admiring this transparency of the air, which gives rise to the most brilliant colours, the most delicate tints unknown to our temperate zone. The reverse picture, of the muggy mist of a tropical calm, will be described later on. Taken on the whole, the transparency of the air and intensity of light may be expected to be less at sea than on land in proportion as the atmospheric moisture is greater on the former. On the other hand, fogs such as cover the British Isles for some part of the year are rarer and of shorter duration on high ocean, at least in the warmer latitudes. In the far south of the Pacific, however, one may encounter fogs, not to be beaten by those of the English Channel.

Last, but not least, the principal difference between sea- and land-climate rests on the difference of the *substratum*—sea instead of land. Instead of the variety of climates which on land may be found within a comparatively small compass, in consequence of differences in the configuration, *i.e.* elevation, and in the geological formation of a country, in the amount and character of the vegetation above, and of decomposing organic and inorganic matter beneath the surface of the ground, or in the humidity of the soil,—instead of all this, we have on the high sea a vast sameness of the *substratum*. This sameness is only slightly varied—in the first place, by differences of temperature in consequence of currents and difference of latitude; in the second, by the different state of the sea. The latter circumstance certainly has to come in under the head of "sea-climate," and indeed is a circumstance of no little importance for the questions I am going to treat of later on.

In consequence of this sameness the sea-climate, on the whole, is certainly much more equable than the land-climate. Take, for instance, the climate between lat. 50° and 40° N. on the continents of Europe and America, and you will find the greatest variety of climates, whilst at sea you may sail through the whole of the said latitudes often without noticing any remarkable difference.

But in ascribing equability to the sea-climate, the common notion often goes too far, a circumstance which cannot be impressed too strongly upon invalids before going to sea for their health, and still more upon their medical advisers in weighing the *pros* and *cons.* This being a cardinal point in the question of the value of sea-voyages in the treatment of consumption, it will receive due consideration in a subsequent paper (No. V.) There it will be shown that as regards equability of climate many places on shore deserve preference to the sea. Apart from the changes which, with the different latitudes on a voyage like my last, often range from below the freezing-point to the most intense and depressing tropical heat within a comparatively very short time, there are at sea, even *within the same latitude and longitude, often considerable and sudden changes,* which moreover make themselves much more keenly felt on board a ship than on land.

At the same time I have to correct another common supposition, according to which the tropical climate is the most equable; as my meteorological journals show, it is not exempt from the changes just spoken of. I remember, for instance, that one day in an equatorial calm, the air after a heavy rain cooled down so suddenly and to such an extent, that the ladies were sitting on deck wrapped up in plaids, and with rugs round their legs. Nor, according to my tables, is the mean daily fluctuation of temperature any less here than in high latitudes. So it was 6·3° F. between lat. 10° N. and the equator (16 days of observation), 5·5° F. between the equator and lat. 10° S. (12 days of observation), whilst in the extreme south, between lat. 50° to 57° 17′ S. (18 days of observation) it was only 3·6° F. In going out, however, the minimum of *mean daily fluctuation of temperature* was observed in rather low latitudes, being 2° F. only between lat. 20° and lat. 30° S., whilst on the homeward voyage that minimum (2·3° F.) was observed towards the end of it, between lat. 40° and 50° N. The maximum of the whole voyage was 10·5° F., and was observed between lat. 50° and lat. 44° S. In short, looking all through my tables, I cannot find any rule as to the equability of the daily temperature at sea increasing or decreasing from the poles towards the equator, nor any difference in this respect worth speaking of between the oceans of the northern and those of the southern hemisphere.

In order to illustrate the question of the equability of sea-climate, I may be allowed to mention a few particular instances.

On a very fine and calm day, in a sub-tropical sea (lat. 31° S., long. 29° W.), the difference between the minimum and maximum of temperature was 17°. The same difference I observed another time, in lat. 42° S., between the maximum of one day and the minimum in the following night. In about the same latitude, the difference even between the mean temperatures of two following days was as high as 14·5° F. In another instance, between lat. 45-47° S., the temperature fell within four days by 21° F.

Whilst I could not find any definite rule with regard to equability of temperature, the *atmospheric pressure* showed a most decided gradual decrease of fluctuation from the poles towards the equator. On the other hand, whilst the temperature steadily increases from the poles towards the equator, the mean of the atmospheric pressure scarcely presents any such difference worth mentioning. Between lat. 40° N. and lat. 40° S. —that is, within a range of 80° of lat.—that mean for every 10° only ranged between 30·31 inches and 30·03 inches, the former having been observed between lat. 40° N. and 30°, the latter between lat. 10° N. and the equator. Beyond lat. 40° that mean did not reach 30 inches, being 29·9 inches for lat. 40-50° N. and for lat. 40°-50° S. 29·495 inches, between lat. 50° and 57° S. 17 inches. The total mean for the northern hemisphere (lat. 0°-50°) was a little higher than that for the corresponding range of the southern hemisphere (30·134 inches, against 30·066 inches).

Of the different oceans and latitudes—the climatic features of which I am now going to give in a general outline—there is not much to be said of the temperate region of the North Atlantic. Few do not know the English Channel; for the Bay of Biscay and the outlying high ocean one has only to add in his imagination a good deal more of boisterous weather, of strong winds, and especially of rough sea; and he has an idea what a hard, disheartening beginning a poor invalid is only too likely to have to get over. Wind and weather in this ocean are, however, so variable, that it would be of little use to detail the meteorological experiences of the four voyages I made over it. At one time, in winter, I found it bitterly cold and stormy; another time, in the beginning of summer, temperate and bracing; a third time, in autumn, already from off Cape Finisterre the climate was most genial and most tropical.

The boundary between the *temperate* and *sub-tropical zone* of an ocean is naturally still less marked than it is on land. It may, however, for the Atlantic Ocean, both south and north of the equator, be put down at about the 35th degree of latitude. Only one must not expect always to find warm weather in those regions; for not only here, but also in the very tropics, it may feel quite cool—more so to one coming from a warm climate. Beside the *cool weather*, two other varieties of weather or climate may be distinguished—the *trade weather*, within the region of the north-east and south-east trade wind—the most perfect climate on earth—clearer, brighter, richer in splendid colours and glorious tints than anything we have in our warm latitudes, and yet very pleasant and enlivening; and in the third place, the *calm weather*. The heat here may be quite tropical as shown by the thermometer; but, the atmosphere being dryer, and consequently the perspiration freer, it is much more bearable.

Our invalid will have to encounter these different sorts of climate to a different extent, according to the class of vessel (steamer or sailing vessel), and the route he is taking (outward or homeward bound). In a steamer he gets over that worst sort of weather—the calms—not only much more quickly, but also with less discomfort to body and mind, there being always motion, and consequently some cooling draught of air.

On the boundary between the temperate and sub-tropical zones of the Atlantic on either side of the equator there is a belt of calms and light variable winds, which in the North Atlantic is called the horse-latitudes.

The homeward-bound track of sailing-vessels, making a large curve to the westward from about the equator on account of the north-east trade, and in order to get into the westerly winds of the North Atlantic, goes right through those horse-latitudes. So, coming home last time, we lay here becalmed for a whole fortnight without scarcely moving.

A phenomenon, which I noticed particularly in these sub-tropical zones, but which is occasionally also to be met with in higher latitudes, especially after a calm and hot day, requires particular attention on the part of our invalid—I mean the *heavy dewfall* which, together with a sharp, piercing breeze, sets in about one hour or half an hour before sunset, and continues for some time after it. I have seen a good many fresh colds, pleuritic affections, neuralgia, and minor ailments, arise from invalids exposing themselves during this time on deck.

In the *tropical* part of the Atlantic on either side of the equator we may distinguish the same three varieties of weather as we have done in the sub-tropical zones. The cool weather, with the sky overcast, and usually with strong winds, may be continual throughout, or it may only interrupt, often all of a sudden, the damp, oppressive heat of the doldrums (equatorial calms), following a heavy thunderstorm and torrents of rain. More often, however, the *frequent heavy rains,* which are characteristic of the doldrums, only serve to render that heat still more oppressive and distressing. In such a calm one even prefers the sun glaring down, with all its tropical intensity, to the dull, muggy, leaden picture, into which sky and sea blend on rainy days. This is another and, I dare say, the hardest climatic trial our invalid has to undergo. The most pleasant time in this climate is the night, and here even invalids may stay up on deck until late in the night with impunity, and they often even sleep on deck under a tent, although I should not recommend the latter.

The climate of the trade winds has been already described; it is, of course, warmer within the tropics, but still pleasant. The trades vary in extent and in strength with the season—*i.e.,* with the march of the sun towards the one or the other tropic.

In the tropics, the highest temperature I observed at sea was going out, 85° F.; coming home, 87° F.; the former north, the latter south of the line. The mean daily temperature within 10° to the south and north of the equator (28 days of observation) was 80° F. The rule that the southern hemisphere has a lower temperature than the northern did not yet show itself in the tropics; the mean temperature within the 10th and 20th degrees to the north and south of the line being, on the contrary, as 77·40° against 78·96° F. But in the sub-tropical, and still more in the temperate regions of the Atlantic, that rate was confirmed. For instance, a mean daily temperature of 20-30° F. was observed at lat. 74·7° N. and lat. 72·2° S.; of 30-40° F., at lat. 68·64° N. and lat. 63·6° S.

These figures are the more to be relied upon as the months of observation in the two hemispheres were nearly or entirely corresponding ones. So, for instance, the months of October and May, when I passed lat. 20-30° N., exactly corresponded to November and April, when I passed the corresponding southern latitudes.

The temperate region of the *South Atlantic* has in its general character a good deal in common with that of the North Atlantic. The difference in temperature between the subtropical and the temperate region seems to be more marked in the south. The prevailing westerly winds are usually stronger, and more to be depended upon. To run before a fresh westerly gale, with a rough sea and a clear, cold sky, is the picture the sailor wishes to see realised in this part of the ocean. In fact, the climate here is, on the whole, fine and bracing, if one is only hardy enough to stand a continually rough sea and an occasional sharp cold. Here it was that in coming home, on the 7th of April, to the eastward of the Falkland Islands, I observed the minimum temperature of the whole voyage—39° F. It is remarkable that at the same time a northerly, not, as might have been expected, a southerly, gale was blowing. In going out, whilst still on the South Atlantic, but already close to the meridian of the Cape of Good Hope, in lat. 42° S., the thermometer fell to 42° F., which was only 1° F. higher than the minimum for the voyage out, which I observed during a fresh west-south-westerly gale about in the middle between the meridians of the Crozets and the Kerguelen Islands in the South Indian Ocean.

This ocean I traversed between the latitudes 41° and 44°. I have got a rather favourable impression of it, as I have of the South Atlantic; the climate is fine and bracing, only the temperature is still lower. The mean temperature of the twenty days we took from the meridian of the Cape of Good Hope to that of Cape Loenwin in Australia was 53·45° F. By the way, I may remark here that the figures I give in this paper refer to the very months in which invalids usually make their voyage to Australia and back, leaving England in the beginning of October, and coming back in June.

Of the South Indian Ocean my impression, no doubt, would have been less bright if we had gone further to the south, *as ships according to usage and the direction of the wind frequently do.* Then I might have had to register intenser and more continual cold, dull, occasionally rainy and foggy weather, and even the appearance of ice in fields and bergs. An invalid sent out on a sea-voyage to Australia in a sailing-vessel must, therefore, be prepared to encounter such a climate.

The South Pacific Ocean is like a grey, dreary blank in my memory—stormy, cold, and wet—"Scotch mist" preventing the sun for many days together from appearing and giving a more cheerful appearance to the vast desert of water. At the outset, however, near the Australian continents and Tasmania, the temperature kept remarkably high; and even between lat. 49° and 50° (16 days of observation), the mean temperature was still as high as 53° F., the extremes being 42° and 65° F. The weather during this period, with its frequent and sudden changes from warm to cold, from dry to wet, quite reminded one of our spring weather, and also had the same effect on the people on board.

The mean temperature out of twelve days, between lat. 50° and our south point (57° 17′) was 45·2° F.; the highest temperature, 49° F.; the lowest, 42° F. The mean atmospheric pressure was 29·53 inches, against 30·13 inches in the period mentioned just before.

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BY C. B. FABER, M.D.,

Late Res. Med. Officer to the German Hospital, London.

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II.—On Sea-life in its Sanitary Aspects for Sailors and for Passengers, particularly Invalids.

The sanitary conditions under which a man has to live are made up of three components—firstly, the climate; secondly, the physical condition of the dwelling-place; and thirdly, the social condition in which he is living. After having described the sea-climate, it therefore remains for us to consider the physical and social condition of that floating microcosm, a ship on high ocean.

Certainly great progress has been made within the last decades towards lessening the horrors of the sea and of sea-life. Voyages have been considerably shortened by the application of Maury's Sailing Directions, by the construction of fast-sailing clipper ships, and especially by the employment of steam. They have at the same time been rendered safer by a knowledge of the law of storms, and by the construction of iron ships. The use of iron in place of wood has also contributed towards the amelioration of the sanitary condition of ships. An iron ship generally is drier than a wooden one; it keeps out that source of contamination of the air, the bilge-water, much better, and if there is any, its smell is less offensive, and its quality not so bad as in a wooden vessel. An iron ship can be also kept clean, more easily and effectually, than a wooden one. But, on the other hand, the latter has, in a sanitary view, certain advantages over the former. A construction of iron excludes that natural ventilation which is going on through the sides of a wooden ship, as far as they are above water. Under a tropical sun, the body of an iron ship is heated like a furnace, and retains the heat during part of the night.

The improvements just mentioned have not, however, been made so much with a view to rendering the lives of those on board more healthy and safe, as for getting higher profits out of the shipping trade. Merchant-ships are still being built on the principle of getting as much room as possible for cargo, and allowing as little room, air, and light as the law will allow to men. Much ingenuity has been bestowed, and oftentimes wasted, upon systems of artificial ventilation for dwellings on land where natural ventilation may be quite sufficient; but the ventilation of ships—a question of grave sanitary importance to the large class of seafaring people, and, it must be confessed, of particular difficulty—remains still in a most primitive state.

The diet-table of first-class passengers certainly has improved, having profited especially by the large extension and the improved methods of the art of preserving all kinds of animal and vegetable food; but the diet of the common sailors is still, to use a strong, but not too strong, expression, abominable. In this respect our convicts are probably better provided for than they. It is my belief that a medical Samuel Plimsoll, furnished with careful and extensive statistics—for which, of course, my own experience is far too short—would be able to bring forward sufficient evidence to convince the public and the legislature of this country of the fact that, to provide a wholesome dwelling and good food for the sailor at sea is no less urgent a necessity than was the Unseaworthy Ships Bill. To this end, every medical man in the large seaports of this country, who is in the practice of sending patients to sea, might contribute by visiting the docks from time to time, and visiting the class of ships he sends his patients out in, so as not only to be well acquainted with the sort of accommodation they have to expect, but also to be able to point out and direct medical and public attention to certain defects and nuisances.

This might prove a wholesome stimulus to shipowners, and lead them to compete in the construction of ships on improved sanitary principles.

In now entering into the details of the sanitary condition of ships on a long sea-voyage, my remarks refer specially to that class of vessels by which alone an invalid can think of going—viz., to first-class passenger (not emigrant) ships.

The most important point, especially to a consumptive patient, is fresh and pure *air*. No doubt a sea-voyage affords more opportunities of getting, or, I may even say, compulsion to get it, than any other climatic treatment. The cabins or the saloon (cuddy) of a ship have no great attractions to keep one, who can possibly go on deck, down below for any length of time during the day. So one spends almost the whole day, and also a good part of the night, in the open air, and will face every sort of weather on the open deck, not only in the fine and hot weather of the tropical and sub-tropical latitudes, but even in less genial latitudes. What an important point this is in reference to the value of sea-voyages in the treatment of consumption will be shown later on.

One might expect the air on the open deck—at least, on board a sailing-vessel—to be as pure as possible. There are, however, even here, sources of contamination. There is, on the main deck, a small steam-engine for distilling water and other purposes, which sometimes sends puffs of smoke and coal-dust over the quarter-deck. Whether the smoke in a steamer ought to prejudice us against recommending this class of vessels to invalids, will be discussed as a principal point in the question—Steamer or Sailing-vessel ? Then there are placed about on the deck, sheep-pens, pigsties, a cow-pen, and a large number of hen-coops, the latter even all round the poop, under the very nose of our invalid. The smell they send forth makes itself perceptible often in a very offensive way, particularly in the damp heat of the tropics, where those hen-coops may become regular hot-beds of bacteria, micrococci, and other productions so famous of late for their (alleged) disease-producing properties. The air in the ship itself is of very different qualities in different parts.

The frigate and clipper-built sailing-vessels and steamers in the Australian trade generally have not a flush deck, but have an upper forecastle and a poop, from which one looks down on the main-deck. This arrangement has, as regards ventilation, a decided advantage over a ship with a flush deck, as I myself have had sufficient opportunity of experiencing, my first ship, a mail steamer, being of the latter; my last one, a sailing-vessel, of the former description. Through the two doors, opening from the poop and the forecastle, on a level with the main-deck and through the companion-ladder of the poop and the hatchway of the forecastle an ample ventilation can be effected. The forecastle, however, which is occupied by the crew, is low, dark, and overcrowded. The poop is not only several feet higher, but has also much more room, air, and light. In the centre is the saloon, with skylights above, which can be opened. The cabins, which run along the saloon, have, on the one hand, a large square window, on the other, they open into the saloon, not only by a sliding door, but also by venetians and above at the ceiling, so that free communication of air is possible all through the poop.

There are usually two or three bunks in a cabin. An arrangement is common in Australian ships, which I have not seen anywhere else, and which certainly is not to be recommended for imitation. Each cabin has a water-closet of its own in one corner. Remembering the free communication of air all through the poop, the consequences of this arrangement as affecting the whole community of the first-class passengers can well be imagined without further explanation. Apart from this nuisance, the ventilation of the poop, in and upon which our invalid is to spend his days and nights, may be considered sufficient, provided that the weather is fine and the seat not rough. But when stormy, rainy, or cold weather, and a rough sea, render it necessary to shut up all those ways of ventilation, when even the daylight is almost shut out from the cabins by the putting on of the "dead-lights," with their dim "bull's-eye," and this for days, and even weeks together, then the air in such close quarters must very soon become far from good, and this state of things must tell visibly upon invalids, especially if they are not strong and hardy enough to face that sort of weather on deck and have some fresh air and exercise. *One* *week of such confinement may undo the good that a month of fine weather at sea has effected.*

In the 'tween deck, where not only the second and third, but in many ships also part of the first-class passengers are quartered, this close and stifling state of the air is almost perpetual, for the sea is rarely so smooth, and wind and weather so steady, as to allow of the opening of the port-scuttles. If it were not for the open hatchways—through which, however, besides the air, in rainy and rough weather, a varying amount of water comes down below—the air here would be stifling, especially if it happens to be contaminated not only by the emanations of the people, but also by those of the cargo (wool, hides, &c.) and of the bilge-water. Take with this a tropical heat, which greatly intensifies all those emanations, and you will agree with me, that a long sea-voyage is for a 'tween-deck passenger neither a wholesome nor pleasant thing.

There are two contrivances for ventilating the lower parts of the ship. The first, for the benefit of the 'tween-deck passengers, consists in wind-sails, a spread of canvas hung up over the main-deck by ropes, and contracting downwards into a cylindric canal, which is fixed over the hatchway. In the calms of the tropics, when ventilation is especially necessary, wind-sails are of course of no avail whatever. The other contrivance, for bringing air down to the cargo, consists in big hollow iron cylinders, the caps of which are taken off in the tropics during the daytime.

I have never found a ship where there was sufficient air and light in the lower parts. Speaking of the air within the ship, it remains shortly to mention the *disinfectants* used on board. The floors (decks) are regularly scrubbed with sea-water and chloride of lime, or some other disinfecting powder. The smell arising therefrom may prove rather trying to an invalid with a weak chest. The water-closets are washed out with the same powders, or with crude carbolic acid. Perfect cleanliness and order prevail in a first-class ship.

The *water* on board a ship of the class I have in view is partly supplied from the land, partly from the sea by way of distillation. Steam-engines have been introduced for this purpose, chiefly with the view of sparing more room for the cargo, but they are also a great improvement in a sanitary point of view as they prevent that distressing calamity at sea, the running short of fresh water. When taking in their supply of water for the voyage, sailing-vessels without those engines appear to discount in advance the supply they expect to get from the tropical rains. If these fail, or if the voyage lasts longer than anticipated, then that calamity arises. Descriptions of it, which I have heard not only from sailors, but also from a retired general, who experienced it even in H.M. troop-ships, make one appreciate the stills more thoroughly.

The distilled water, which is consumed during the greater part of the voyage, is almost chemically pure, and not at all so tasteless as might be expected. Perhaps it is the contact with the iron tanks, in which all fresh water is kept, and the contact with the air in the process of filtering it from the flakes of rust from the tanks, which gives it some taste.

The natural fresh water keeps very well in those tanks, even during a long voyage. That in the wooden tanks formerly in use it often turned bad, and became disgusting to the nose and the palate, I can easily believe. I remember, during a fearfully hot time at Melbourne, the thermometer standing as high as 110° F. in the shade, how delicious and cool the London water tasted, of which about sixty gallons were fortunately found left in one of the tanks. In that time of extreme scarcity of water, our discovery was soon known among the shipping, and people came far for the sole purpose of asking for a drink of water, and wanted even to buy it.

The quantity of fresh-water allowed to each passenger and sailor for drinking, cooking, and cleaning purposes, is three quarts a day. First-class passengers, however, are not restricted to this measure. They can, within reasonable limits, usually get as much water as they want. Rain-water may be collected by sailors and passengers of the lower classes. After a heavy tropical rain, there is usually a general washing-day on the main-deck and forecastle. Most ships have bath-rooms, where cold sea-water baths may be taken. Besides this, in the tropics, gentlemen passengers may have a morning bath on the poop-deck, consisting of several buckets of salt-water poured over their heads by sailors.

Of *drinks*, the crew and third-class passengers receive water, tea, coffee, and lime-juice. Only on extraordinary occasions, or after very hard work, is a ration of rum or gin served out to the crew by order of the captain. This teetotalism at sea is no doubt advantageous to the shipowner, but it is questionable whether it is good for the sailor, and has not a good deal to do with his excessive intemperance in port. I may mention here the often-observed fact, that most people require, or at least may take with impunity, more and stronger stimulants at sea than on land. Adult second-class passengers are allowed one pint of porter daily, and one bottle of wine a week. First-class passengers have to pay for all their drinks except water. There are the usual sorts of spirits, wines, and beer.

Lime-juice deserves particular mention here, because it is generally believed to be *the* anti-scorbutic. But, as Dr. Garrod has shown, it is not the want of organic acids, but of potash in the food by which scurvy is caused. The blood in scurvy is according to him deficient in potassic salts. Lime-juice contains a good deal of potash, yet, as it cannot well be taken in quantities large enough for this purpose, it does not secure a sufficient supply of those salts to the organism. This is shown by the outbreak of scurvy in ships where lime-juice had strictly been used. Fresh potatoes are much more effectual as an anti-scorbutic than lime-juice, as they, according to Dr. Garrod's valuable analysis, contain about as much again of carbonate of potash, and may, moreover, be taken in much larger quantities. A still more effectual anti-scorbutic is, in my opinion, *Liebig's extract oj meat.* As to the nature and the mode of action of this extract there is a wide-spread misconception, by which essentially and directly nourishing qualities are ascribed to it. Nothing could refute this notion more effectually, than the fact, that of two animals, say dogs, of which the one is put to absolute starvation, whilst nothing but Liebig's extract of meat is given to the other, it is the latter that dies soonest.

The essential qualities of Liebig's extract rest on its principal constituent, potassic salts. These not only form a most important constituent of our organism, especially of the bioplasm by which it is built up and continually restored, but they moreover accelerate this process. They act as a stimulant to the tissue-change (*stoffwechsel*). In this circumstance the explanation of the experiments mentioned just now is given.

Scurvy consists not only in a deficiency of potassic salts, but also in an extreme sluggishness of the "stoffwechsel," which takes the form of a specific dyscrasia. In the treatment as well as in the prophylaxis of this constitutional disorder two requirements have to be fulfilled. Liebig's extract of meat, as has been shown, does this. Potato food may supply the organism with a sufficient quantity of carbonate of potash; lime-juice does even that insufficiently. Therefore that food may prove sufficient to prevent a full out-break of scurvy; but it cannot prevent altogether that lowering and debilitating effect which the sailor's life and, above everything else, the sailor's food has on the organism, and the features of which will be given in a later paper "On the Physiology and Pathology of Sea-Life." Certainly the stimulating properties of the potato, if it has any, cannot be compared with those of Liebig's extract of meat, which, if combined with sufficient nourishing food, enables an organism reduced by acute disease quickly to repair its losses, thereby shortening the time of convalescence, and on the other hand prevents a healthy organism from being deteriorated by food otherwise unfit to keep it in lively function and vigorous action. Besides, a soup simply made of Liebig's extract of meat, hot water, and some bread, biscuit, or rice boiled in it makes a palatable dish, which is more than can be said of most things in the sailor's bill of fare as it is at present.

After what has been said I need scarcely add that I should consider it a great and material improvement if Liebig's extract of meat were added to that bill of fare *by law.* One or two teaspoonfuls a day per man might be sufficient, and the cost of that improvement would be trifling compared with the good it would do not only to the sailor but also to the employer, by keeping up the vigour and the efficiency of the former even during the longest voyage.

At the same time, however, I would not by any means recommend the omission of potatoes and lime-juice from the dietary regulations for seamen. For the former a vindication is superfluous. Who would like to be without potatoes in one shape or other for a week only?

Lime-juice makes a pleasant and wholesome drink in hot climates, refreshing and cooling and at the same time acting on most people as a mild aperient. I have seen babies taking the breast affected by it too much in this way, so that the mother had to give up taking lime-juice. A good many people take it too concentrated, then it not only affects the bowels, but also the stomach, impeding digestion and spoiling the appetite. I have found the right dose to be just enough lime-juice to cover the bottom of a tumbler which should be filled up with water.

Passing from the fluid to the solid food I have to repeat that the seaman's bill of fare is not a particularly inviting one. Salt beef or pork every day of the week but one, when there is preserved Australian meat; suet, rice, potatoes twice a week, biscuits, a paste interspersed with some raisins, called pudding, those are the principal things that make it up, and on this the seaman has to subsist for months together without any change. Is it to be wondered at that after some time at sea even old seamen, whose stomachs have been accustomed to this diet for twenty or thirty years, find it trying not only to their taste and digestion, but also to their constitution?

The salt beef and pork are kept in wooden casks, but do not always keep well. I remember in the second part of one of my voyages, when such a cask was opened on the main-deck, all the passengers on the poop used to run towards the stern as if for their lives holding pocket-handkerchiefs or smelling-bottles to their noses.

With regard to the *preserved Australian meat* I must confess that before I went to sea I shared the prejudice against it so common in this country. But soon I came really to like it and to appreciate it as a beneficial change from mutton, pork, and poultry, although these come from the live-stock with which the ship is provided for the first-class passengers all through the voyage. In hot weather, however, the savoury and nourishing jelly with which it is covered melts away and the juice it contains oozes out, so that the meat remains neither palatable, tender, nor nourishing. Apart from this, the only fault I have found with the preserved Australian meat is, that it is very often too much cooked in the process of preserving. Since the plan has failed of sending whole ship-loads of fresh meat packed in ice over from Australia, the meat-preserving companies ought to pay particular attention to cooking the meat as little as possible.

The common biscuits, as the seaman gets them, are much more difficult to digest than bread for two reasons: first, they contain much less water, which makes them less easily soluble in the stomach; secondly, they are of a rougher material than our usual bread. In masticating a biscuit of this description it requires a large amount of saliva to get the several particles moist and soft enough to be swallowed without their irritating the throat. It would be an interesting point to make out whether, according to the theory of natural selection, this circumstance, together with the habit of chewing tobacco common among sailors, would lead in the course of a number of generations to an inherited enlargement of the salivary glands.

The improvements in the diet regulation for seamen, which I consider necessary from a sanitary view, are the following:—

Preserved meat	3	times a	week.
Fresh potatoes	4	"	"
Cabbage, turnips, peas or beans	3	"	"
Fresh bread	3	"	"
Liebig's extract of meat			

This list is of course not to be taken as a complete diet scale, but as a supplement to and a substitute for the existing regulations which certainly cannot be called extravagant.

The scale of victualling for the third-class or intermediate passengers is not much above that of the seamen. That of the second-class is better and more varied, but there is no fresh meat in it. The cuddy-table is well supplied with everything that can be had at sea. There is fresh meat every day of the different kinds already mentioned, preserved meat, fish, and shell-fish, vegetables of every description so well preserved that one might take them for fresh, fresh potatoes, fresh fruit at the beginning only, but preserved fruit of every kind made up in puddings and tarts, jams, and fresh bread every day all through the voyage.

But notwithstanding this variety, and the good quality of the several articles, which at first sight might well make one forget that he is on high ocean and not in a good class English hotel, sooner or later a certain monotony makes itself felt not only to the palate, but to the system in general, all the more that as a rule ship cooks pay little attention to getting things up nicely and temptingly. More and more one misses and longs for those "nice little things" which cannot be well had at sea, but which have become almost necessities in our epicurean age. Then even fresh eggs, fresh butter, fish and oysters, fresh fruit, lettuce, and watercress appear to one who has not seen land for a good long time as the greatest possible delicacies which he would readily pay anything for if he only could get them.

The ship cow, which, side by side with the stewardess and the "experienced surgeon," figures daily in the shipping advertisements, supplies fresh milk, which, however, as may be expected, is not of very good quality and does not go far, being for the most part required for infants and sick people. So Swiss preserved milk has to come in as an important supplement.

The same enemy, which stealthily comes over the dinner-table and takes away the relish from the meals and to a greater or less extent the appetite, Monotony, sooner or later creeps also into society. The quietness of sea-life is, from a therapeutic point of view, generally considered one of the principal points in favour of it. This is certainly true to a certain degree and extent. But it must be admitted, on the other hand, that, when it makes itself felt as monotony, its beneficial influence becomes doubtful. The period after which one grows weary of sea-life of course varies considerably according to the individuality of a person, his or her relations and liking to the ship's company, especially fellow-passengers, according to the sort of accommodation and life on board, to the state of the weather and sea, the expected duration of the voyage. To fix the period a sea-voyage ought to last for invalids, I reserve for a later paper.

If one is lucky and at the same time able to "rough it," and accommodate himself with good will and temper to a number of people with whom he is brought into such close, continual, and inevitable contact, he may find a nice and pretty homogeneous company, which will soon form into a sort of large family-circle and combine their several resources to keep that enemy, *ennui*, away as long as possible. The ways, however, in which this is done are often not at all suited for invalids, and I frequently had to remind them to abstain from taking part in theatricals; running, jumping, climbing, boxing and similar matches. In the southern oceans angling and flying lines for those large sea-birds of the Petrel family, with which those regions abound, diverts the unoccupied energies for many an hour.

But he must be of a dull mind who is satisfied for months with nothing more than conversation, novel-reading, sketching, games, and sports such as those just mentioned. A more active and intellectual mind will long for better occupation to spend part of the day in, so as to give some relish to the idleness of passenger sea-life. A professional man will not be at a loss in this respect; he will even find that he has much less time to himself than he may wish for.

In disagreeable society a long sea-voyage is a hard trial, if one cannot make himself independent of it, as far as the close social contact on board a ship will allow it, in the way just hinted. A sea-voyage, therefore, also in a social regard, involves a good deal of risk, a fact which is particularly important to an invalid, the more so, if he be without a companion from home.

The sailor's life at sea is very different from that of a passenger. Instead of monotony its principal characteristic is irregularity. Days of quiet and idleness, when scarcely a rope has to be touched or a mast to be climbed, as in the trade-winds, may be followed by days and nights of constant alarm, when the men scarcely get a wink of sleep, and besides being hard-worked may be cold and wet through all the time. In this respect the South Pacific Ocean, particularly off Cape Horn, and the English Channel are notorious.

But the irregularity of the sailor's life is still greater on land than at sea, and moreover the contrast between sea and land life very great. Of the consequences I shall speak in a later paper.

Here it only remains to mention a class of "hands on board," the lot of which, in my opinion, is the least enviable of all; I mean the engineers and firemen in steamers. Their work, deep below in the hold of an iron ship, in a temperature which I am assured in the tropics often reaches 120° F., involuntarily reminded me of slave-labours. Seeing them come up from the engine-room streaming with perspiration and their generally pale and haggard faces covered with soot, one cannot help the impression, that their wages, high as they are compared with those of the seamen, are hardly earned.

3

ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

BY C. B. FABER, M.D.,

Late Res. Med. Officer to the German Hospital, London.

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III.—ON THE INFLUENCE OF CLIMATE AND OF SEA-LIFE ON THE BODY-TEMPERATURE, PULSE, AND RESPIRATION.

ONE often hears the power the human organism possesses of keeping up a nearly constant temperature under, and adapting itself to, external conditions different in the extreme, described as wonderful. But is it not quite as wonderful that other animals can do without that power, the want of which would be the certain death of the human organism? And yet a frog that lies under the frozen surface of a pond for months is kept alive by vital functions essentially the same as those which constitute human physiology. One has not even to look out for cold-blooded animals. Those warm-blooded animals that sleep through the winter in hollows of trees or underground, can exist under conditions which would certainly prove fatal to the human organism.

Is it not quite as wonderful that bioplasm exactly the same to our most minute inquiries, and fulfilling the same vital functions, yet has such different vital powers, such different power of resistance, as that the bioplasm of man has such a small range of vital resistance; in consequence of which the human organism, in order to keep alive, must contrive to keep within the narrowest limits of animal heat?

As regards that power of adaptation to different external conditions, often a superiority has been ascribed to the human organism over that of lower animals. But if there be any such superiority, in my opinion, it only rests on the use of artificial means, which man's superior intellect places at his disposal. Not only can he, wherever he goes, provide himself with the same sort of food he is accustomed to and which suits him best, but he can also regulate his whole mode of living and clothing in accordance with the altered external conditions. An animal cannot do this, at least not nearly to the same extent. It has no artificial means for adapting itself at once to conditions which may be very different from those it has been accustomed to for long generations; it cannot alter at once its external covering according to the different temperature; it may not find food that suits it well enough for the maintenance of health.

Yet we see a great many instances of animals, not only domesticated, but also wild ones, adapting themselves to a different climate and thriving in it even far better than the newly immigrated human race. On the other hand, all the highly cultivated intellect of man cannot as yet prevent the number of new-comers from being sadly decimated in certain climates if a change is not taken in time. On the contrary, we see wild animals imported from tropical countries to Europe keep alive for many years and even propagate their race under conditions far from natural. I believe, if one were to take up the study of comparative climatological physiology, he would be amply repaid by many most interesting results for the difficulties that have to be overcome.

For studying the economy of the human organism, and the question in particular what changes it undergoes in order to adapt itself to different external conditions, we have two principal ways. The first is an exact qualitative and quantitive analysis of the ingesta and egesta. This method not only requires an experienced chemist, a chemical laboratory, a large amount of time and painstaking, and is therefore out of the question for a medical officer on board a passenger-ship, but also, if executed *lege artis*, it still presents very material defects, which are all the more grave as they principally concern that part of the economy of our body which, for our present subject, is the most important link in the chain one has to render complete.

It is the skin and the lungs that are concerned more than all the other organs in effecting that adaptation by changing their vascular and secretory action according to external conditions. But not only are our methods of controlling the so-called insensible loss, *i.e.* of the qualitative and quantitative analysis of the perspiration and respiration, far from being exact, but we know still less of the extent of the assimilative power those organs may possess.

If I dare venture on hypotheses, I should suggest that not only the lung, but also the skin of warm-blooded as well as of cold-blooded animals is an essential organ of respiration; that, on the other hand, not only the skin but also the lung is an essential organ of "insensible" secretion; that both of those organs, lung and skin, not only appropriate and assimilate oxygen, but also other chemical elements and compounds from the air.

Certain creepers suspended freely in the air on a piece of wire not only, as Dr. L. Beale informs me, live, but in an atmosphere sufficiently moist also grow in size and weight. They therefore must get from the air everything they require. Why should not also the surface of the animal body be able, if not to the same extent, to appropriate and assimilate food from the surrounding air? I only adduce this hypothesis to show that there is more than one difficulty in the way of an exact and complete analytical method for determining the different processes that constitute the economy of our body; and I refrain here from dwelling on the importance which the questions involved in that hypothesis may prove to have for animal physiology and pathology.

The second way of getting an insight into and ascertaining changes in the economy of the human organism is so simple, that one can easily avail himself of it, even in the vicissitudes of sea-life. It is by thermometry, which it is the immortal merit of Wunderlich to have made a part—and that a most essential one—of what lawyers call common learning for our profession. The difference in the results arrived at by these two different ways, the analytical and the thermometrical, is best explained by having recourse to the often-used, but not particularly fortunate comparison of the human organism to a steam-engine. The first way shows with what and with how much fuel the engine has been fired, and to what the fuel has been burnt in producing heat and labour. The thermometer only takes the place of the instrument indicating the pressure in the boilers or on the safety-valve, which does not tell anything of the chemical and physical process itself by which that pressure is produced. These instruments do not even give an exact measure of the quantity of ingesta necessary for producing that heat or pressure, for that quantity alters according to different external conditions. Surrounded by air of a high temperature the body loses less heat than in cold air, and therefore, although less heat is produced by the body, yet the thermometer may give a higher body-temperature in the first than in the second case.

This objection is especially important for our subject. It therefore would be presumptuous if in the following I should draw any direct conclusions regarding changes in the economy of the body from the difference of body-temperatures, as we have a good right to do with a fever patient in whom the external conditions remain the same. The relation, however, between air- and body-temperature has in itself sufficient interest.

For regular observations on body-temperature at sea and in different climates I at first hoped to get a number of healthy, intelligent, and reliable persons, and I accordingly distributed a number of thermometers, and instructed the several persons how and at what times to apply them. But they soon gave it up, either not understanding how to make a correct use of the instruments, or being tired of using them at all. Only one person acquired that use satisfactorily, and continued it for some length of time. I myself have made observations on myself regularly at least twice in twenty-four hours (morning and night) throughout the whole of my last voyage (round the world), the place of application being invariably the axilla, where the instrument remained for at least ten minutes. The results I am going to give are mainly based on my own observations.

The question here being not of absolute, but of relative figures, as showing the increase or decrease of body-temperature under the influence of climate and sea-life, I may be pardoned for not giving my temperature-curves, the more easily so as they are a good many feet in extent. Also a condensed table giving the mean and extreme readings of the barometer and the thermometer, the mean body-temperatures, the mean frequency of the pulse, morning and night, side by side, for each ten degrees of latitude on the outward and homeward voyage would be too voluminous for this paper. Besides, it is a well-known and rather natural fact that the general reader, horrified by the sight of such swarms of figures, hastily skips over tables, and at the most can only be brought to take notice of the results derived from them.

An analysis of my curves and tables shows the following *relations* to exist *between body-temperature* on the one, *and external temperature and sea-life* on the other hand.

On the outward voyage the body-temperature rose continually, but inconsiderably, and not at all in exact proportion to the air-temperature, from England to the equator. The total rise of the *mean* air-temperature amounted to about 20° F., that of the *mean* morning body-temperature to 0·33°, of the night-temperature to 0·54° (mean out of both = 0·43°). The greater rise of the night-temperature might partly be explained by the iron ship being intensely heated by the tropical sun during the day, and retaining heat during part of the night. The mean total rise of the body-temperature might, therefore, be put down as even a little less than 0·43° F.

In another series of observations already mentioned, which, however, does not extend over the whole voyage from England to the equator, the body-temperature did not even show a constant rise. Whilst in the first half of the tropics north of the line a rise of the afternoon temperature by 0·52°, and of the evening temperature by 0·64°, corresponded to the rise of the mean air-temperature (5·9°), as compared with the sub-tropical region, both the afternoon and evening temperatures commenced to fall again already in the second half of the northern tropics by 0·35° and 0·55° respectively, notwithstanding a further rise of the mean air-temperature of 1·2°. Of the fact that *air- and body-temperature may be* not only disproportionate in their simultaneous rise or fall, but *entirely at variance*, so that the latter may fall, whilst the former rises, or the reverse, I could bring forward a good many instances.

It is not out of the place to compare here the accounts other writers have given of the influence of tropical climates on the body-temperature. John Davy states that not only is the mean body-temperature in the tropics about 1° F. higher than in temperate climates, but that also its daily fluctuation is different, and that in particular mental exertion causes a much higher rise of the body-temperature in the tropics than in a temperate climate (up to 104° against 98·7°). Certainly an individual whose body-temperature is by mental exertion, even in the very hottest of the tropics, ever raised to 104°, is not likely to be a normal one! Another explanation of that remarkable statement is, that these observations are not so reliable as might be wished, in consequence of the place of application of the thermometer, about which more below.

I myself have, within the tropics, had most intense mental exertion, by itself as well as combined with physical exertion, but the highest temperature I ever observed was 99·8° (in the afternoon), and even that was quite an exceptional case, on a day with a mean air-temperature of 81·5°. As a rule, my temperature in the tropics on days of intense mental and physical exertion did not exceed 99·0°. The individual who beside me took his temperature regularly, at least for some time, had, within the tropics, often to work hard down below in the heated hold of the ship in the capacity of an officer. Yet his temperature, taken shortly after, only three times exceeded 99° by six-tenths of a degree at the most.

As regards the regular daily fluctuation of the body-temperature, which not only John Davy, but also Dr. Rattray find different within the tropics from that observed in temperate climates, the latter giving an average of 2° F., I have to remark, first, that this figure is not above the normal range of daily fluctuation as observed in temperate climates; secondly, that my own observations, made all through the tropics twice over, under external conditions sufficiently varied, have not shown any difference in the range of the daily fluctuation to exist.

On another point, however, Dr. Rattray's statements, taken from a voyage to Bahia (2 degrees lat. S.) and back, come near to my own observations as already detailed above. According to him, the rise of body-temperature from the temperate to the tropical climate was 0·3° F. The mean air-temperature, he gives for the tropics (76·9°) is lower than that I observed (79·05°). In the doldrums he found the body-temperature still further increased by 0·4°, and even as high as 1·4°. Coming home, I have had the fullest benefit of those horrid doldrums for comparative observations, with an air-temperature as high as 87° F., but I only found an increase of the mean body-temperature of 0·02°. It makes, however, as will be shown later on, not a little difference whether one encounters the doldrums on the comparatively short trip to Bahia, or after having been at sea for a number of months.

Brown-Séquard, on a voyage from France to Mauritius, took the temperature of eight healthy persons between 17 and 55 years of age, first at the time of departure, and found a mean of 97·9°, the air-temperature being 46° F. A week later the former had increased by 1·4°, the latter by 31°, and nine days later still, on passing the line, a further increase of that mean body-temperature of 1·9° was observed, whilst the air-temperature was 85°. This would make a total rise of the mean body-temperature of 3·3° F. ! This way of taking the body-temperature only three times within several weeks, although of a number of persons at the same time, I scarcely consider a reliable one. Another objection I have to make to all those former observations (Davy, Rattray, Brown-Séquard) mentioned, is as to the place of application of the thermometers, which was the mouth. As I shall show somewhere else, the mouth is not a convenient place for observations on body-temperature for *scientific* purposes, even if the external conditions remain the same, and less so still in our case, where the influence of the air on the body-temperature is the object to be determined. No part of the body, the extremities excepted, is more affected by changes of the air temperature than the mouth, the cavity of which is cooled down or heated, as the case may be, not only by the air passing through it, but, even if shut, in consequence of the thinness of the walls, by the surrounding air. Also when the mouth is shut the air has still access to its cavity by way of the nose and, may cause currents in the latter. The axilla, on the contrary, can easily be closed hermetically, and then represents a cavity, the external walls of which have a thickness of 4-8 cm. In any state of indigestion, which is very common with people coming from a temperate into a tropical climate, and moreover not accustomed to the diet on board, in any case of "cold in the head," which also is common at sea, the mouth will have its share of irritation, quite apart from the parched state in which it often is in the heat of the tropics. Smoking is one of the greatest comforts at sea, but certainly not conducive to getting the real body-temperature from the mouth. I do not, however, know whether Messrs. John Davy, Rattray, and those eight individuals that served M. Brown-Séquard for his observations were smokers at the time, or at all.

So much for the relation between air- and body-temperature in entering the tropics outward bound. I purposely distinguish throughout between the outward and homeward voyage, so as to bring out the effect of sea life on the body-temperature as independent from that of the air-temperature.

From the equator to the south point of the whole voyage (57° 17′ lat. S.) the mean air-temperature showed a continual, but not gradual decrease of 33·7° F., whilst the body-temperature followed no such rule. It at first decreased not inconsiderably (about 0·5°), although in the respective range of latitude (0°—10° lat. S.) the mean air-temperature was only 0·48° lower than in the preceding one. It has already been mentioned that this reaction—for such I take it to be—obtained already north of the line in that other series of observations. I ascribe it to two different causes, the first of which comes within Furgenson's "law of compensation;" the second is to be found in the continual and considerable loss of heat by the profuse perspiration.

It is remarkable that, whilst the mean morning temperature before had risen less high (0·33°), now it also fell less (0·33°) than the night temperature (previous rise 0·54°, fall 0·64°). So within ten degrees of latitude, and with a fall of the mean air-temperature of scarcely half a degree, the body-temperature lost even more than it had gained within 50 degrees of latitude and ith a rise of the air-temperature of 20°.

In the second series of observations the loss during the former period was less, the reaction already setting in north of the equator. It only amounted to 0·12° both for afternoon and evening temperature; but both periods (10° lat. N. to 10° lat. S.) taken together, it amounted to nearly the same as in my own observations (0·47° and 0·67°).

In the second part of the southern tropics, in both series, the mean body-temperature rose again, although the mean air-temperature continued to fall (1°). Altogether, from here all the way to the south point *there could scarcely any relation be traced between air- and body-temperature.* Still, although the respective figures as computed for every ten degrees of latitude are sadly at variance, and rises of the mean body-temperature in frequency, if not in extent, even exceed the falls, the total balance gives a fall of the mean body-temperature of 0·45° (morning temperature 0·20°, night temperature 0·69°). The fall of the mean air-temperature within the same range was 33·7. The former seems quite out of proportion to the latter, and more so when compared to the previous rise, although itself inconsiderable, a rise of the body-temperature of 0·43° corresponding to a rise of the mean air-temperature of 20°.

On this circumstance one might, therefore, base an objection to the assertion of the lowering effect of sea-life on the body-temperature. My answer to this, based on the figures I am going to give later on, would be, first, that this effect does not show itself before a certain period of the voyage, and then very gradually—of which more in the next pages, where I shall speak of the same effect on the human organism in general and its different functions; secondly, that the law of compensation already referred to applies equally to the case of increase and decrease of the normal body-temperature.

It will be seen that the statements of former writers on this point differ from the ones I have made just now. I do not think this is due to individual differences; for the temperature of healthy people is something remarkably constant; and this discrepancy I mainly attribute to their having chosen the mouth as the place of application for the thermometer.

John Davy observed a decrease of the body-temperature of about one degree and a half, corresponding to a fall of the mean air-temperature of about 20°.

Brown-Séquard found a proportion of 1·2 to 34°, the latter figure representing the decrease of the actual air-temperature observed at the times of taking the body-temperatures.

In returning, from lat. S. 57° 17′ to lat. N. 50°, there is still less regularity to be noticed in the relation between air- and body-temperature, than on the voyage southwards. At one period both the morning and night temperature follow the rise or fall of the air-temperature ; at another only one of them ; at another again, both of them take the opposite course. So, whilst the increase of the mean air-temperature from the south point back to the equator amounted to 35·5°, the total numbers gave for the mean morning body-temperature an increase of 0·30°, for the night-temperature a decrease of 0·26°. Taking the mean out of the two we get an increase of 0·02, or exactly as much as had been lost on the whole way from England to the south point. In this instance, therefore, the heat of the tropics, although in consequence of calms much more keenly felt and oppressive, does not show any influence to speak of on the body-temperature.

From the equator back to England the fall of the mean air-temperature was 19·7°, that of the mean morning temperature 0·09°, of the night temperature 0·55° (mean out of the two = 0·32°). The same irregularity in the relation between air- and body-temperature prevailed also here, as on the voyage from the equator to the south point and back.

This irregularity I believe principally to be due to the *influence of sea-life on the body-temperature* interfering with that of the air-temperature. That influence, as has already been remarked, is in the later part of a long sea-voyage *a decidedly lowering one.* After what has been said in the preceding papers of the peculiarities of sea-climate and sea-life, and what in the next paper will be stated "On the Physiology and Pathology of Sea-life," that fact needs no detailed explanation. One might with an apparent show of reason attribute that fall of the body-temperature which shall be analysed presently, to the high latitudes, *i.e.*, the low temperature, in which on a voyage round the world, *viâ* Cape of Good Hope and Cape Horn, one is sailing for such a long time. But my tables show nothing whatever to confirm this view. On the contrary, there is a sort of reaction to be noticed in those high latitudes, which I believe to be analogous on a large scale to the effect of sipping on the body temperature, as shown by my friend Professor A. H. Garrod, Liebermeister and others.

The details of that fall of the mean body-temperature present an interesting and somewhat puzzling *relation of the morning and night-temperature.* Already the figures given above indicate the incongruous course they take ; but a short summing up will make this more conspicuous.

The mean morning temperature as computed for each ten degrees of latitude and compared to the mean of the preceding period shows, from the north point (50° lat. N.) to the south point (57° 12′ lat. S.), a total increase of 1·19° against a decrease of 0·96° (mean air-temperature + 20° — 33·7°), *i.e.* a surplus of 0·23°, the night-temperature within the same range, an increase of 1·26° against a decrease of 1·41° *i.e.* a deficit of 0·15°. So the former gained 0·08° more than the latter lost.

This antagonism is still more apparent on the voyage from the south back to the north point, whilst the balance of the mean air-temperature remained about the same (+ 36·8° — 21·0°). The total increase of the mean morning temperature was 0·69°, which together with the opposite course of the night-temperature became the more apparent, *i.e.* made the daily fluctuation the less, the nearer the end of the voyage. The total decrease of the morning-temperature was 0·47°, the surplus therefore = 0·22°. There is a total increase of the morning-temperature on the whole voyage = 0·45°.

The night-temperature within the same range showed a total increase of 0·53°, a total decrease of 1·34°, *i.e.* again a deficit of 0·81°. There is, therefore, on the whole voyage a total decrease of 0·96°. The balance with the surplus on the part of the morning-temperature leaves still *a deficit for the body-temperature* amounting to 0·51°, or *half a degree,* which I consider to be due to the lowering effects of sea-life.

That this is so is confirmed by the fact that after I had again accustomed myself to land-life (at London) my mean body-temperature taken as regularly, and the same way as at sea, showed an increase of 0·49°. So almost exactly the same had been regained within ten days after my landing that had been lost during a voyage of eight months and a half.

As to the opposite course of the morning and night-temperature assumed during this period, I can only offer a suggestion for explanation. Should it come from the reversion of the seasons, or, what is more probable, from the gradual advancing of the day-time one experiences on such a voyage round the world? Everybody knows that making it from west to east, as I did, one seems to gain one day, and actually has to interpose one extra day so as not to be on his return ahead of the then date by one day.

Here I append a short table on the influence of extraordinarily high air-temperature on the body-temperature and the pulse observed at Melbourne during hot wind-days.

	11 A.M.	1 P.M.	3·30 P.M.	5·30 P.M.
Air-temperature (in the room)	94·5°	96·8°	100°	100·5°
Body-temperature	98·7°	99·6°	99·6°	99·4°
Pulse	84	104	104	110

The following day:

	9 P.M.	3 P.M.	5 P.M.
Air-temperature (in the room)	89·8	99·2	100·5
Body-temperature	98·4	99·2	99·6
Pulse	80	98	104.

The air was very dry, and although large quantities of iced waters, partly pure, partly mixed with claret or brandy, were taken, the perspiration as far as could be seen was nothing compared to that in the tropics at a much lower temperature, and the heat altogether less oppressive, although almost burning.

It now remains to give an account *of the influence air-temperature and sea-life have on the respiration* and the pulse. The former appears to be the most constant element of the three. Under ordinary conditions, *i.e.* no particular exertion preceding, I always found its frequency to be at my normal standard, *i.e.* about sixteen respirations per minute. In that abnormally high extreme temperature I have given in the above table, it was somewhat hurried; whilst in a dog who, however, appeared to suffer from fatty degeneration of the heart, it was so much so (from about 140 to 170) that I expected him to breathe his last during that hard climatical trial, which indeed cost some hundred human lives at Melbourne. He however survived, but was, on the homeward voyage, not nearly so well as before.

The influence of the air-temperature on the frequency of the pulse was still less marked and still more irregular than that on the body-temperature. Both, however, followed on the whole the same course, as will be seen from the following details. The relative increase of the mean frequency of the *morning* pulse in going out was 21·5 beats, the decrease 13·5, *i.e.* a surplus of 8 beats. In coming home the increase was 4, the decrease 10·5, *i.e.* a deficit of 6·5 beats; and the balance for the whole voyage gives a surplus of 1·5 beats.

The figures for the *night* pulse are in going out + 21 — 15, *i.e.* a surplus of 6; in coming home the decrease of the night pulse was even more marked than the corresponding one of the night-temperature, and was continual with but *one* exception, when from the period between lat. S. 30-20° to that between lat. S. 20-10°, it increased by 3·5 beats. Against this increase stands a decrease of 15·5; the deficit is therefore = 12 beats.

So all in all, the frequency of the pulse decreased throughout the voyage by 4·5 beats.

The objection might be raised that this deficit seems too insignificant to deduce from it a lowering effect of sea-life on the pulse, and that it might be merely accidental. But if there have been any accidental influences they certainly must have tended rather to raise the pulse-frequency; besides, such a long time of observation, extending over many months, almost excludes chance results. The most conclusive proof, however, is the analogy in the relation between morning and night-temperature on the one hand, and between morning and night pulse on the other, throughout the voyage and some time after landing. At sea the body-temperature had decreased by 0·51°, on land, after ten days, it had increased by 0·49°; at sea the pulse-frequency had decreased by 4·5 beats; on land after the same time it had increased by 6 beats.

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ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

BY C. B. FABER, M.D.,

Late Resident Medical Officer to the German Hospital, London.

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IV.—ON THE PHYSIOLOGY AND PATHOLOGY OF SEA-LIFE.

IN this paper I am going to give an account of the influence of sea-voyages and sea-life on the human body, which is based upon a careful analysis of my extensive medical journals. I am going to show in what way the functions of the human body are influenced by sea-life, within the limits of health and beyond them; which are the diseases and ailments prevailing at sea; and in what way the ordinary types and course of diseases, whether acquired on board or imported, are influenced or modified by sea-life. I shall have to speak of the influence of sea-life on the organism in general, and on the constitution of healthy and sick people in my next paper (V.) in connection with the question of the value of sea-voyages in the treatment of consumption.

Before I commence with an account of the general disorders which came under my notice at sea, I may be allowed to speak of the opportunities a medical officer on board a first-class private passenger ship has for observing and treating his patients. The Passengers' Act, 1855, provides a hospital room to be kept free in large vessels. Yet I have not seen or heard of anything of the kind, although I have inspected a good many ships of this class. Still I consider the enforcement of this provision as much a matter of humanity as a strict supervision of ships as to their seaworthiness. Take a seaman falling seriously ill and lying in his wretched bunk or hammock in the forecastle, and you can scarcely have a worse place for attending a patient, and for his getting well again. It is a low room where even in large ships a tall man cannot walk upright; in rough and wet weather it is damp and badly ventilated, with a thick, stuffy air full of tobacco smoke and the smell of a variety of indescribable human emanations; when it can be ventilated, there is usually a strong draught. At no time is there sufficient light and room. The access to the patient is a matter of the greatest difficulty; to examine him candle-light is required even in the middle of the day. The noise and running about in the forecastle is continual both day and night. In one word, a patient has neither sufficient air, light, nor rest, not to speak of comfort or even cleanliness. It must be well understood that I am speaking of an upper forecastle in a first-class ship, not of one of those often much more abominable places, a lower forecastle.

Against similar hygienic disadvantages medical treatment has to struggle on the lower deck (mid-deck). Even in the saloon cabins a careful examination of a patient presents peculiar difficulties. Particularly annoying is the continual noise inside and outside the ship. In rough weather percussion and auscultation is a most difficult task, which often must be deferred. In surgical operations there is no skilled assistance to be had, and the operator may have to chloroform his patient at the same time. The motion of the vessel may prove trying even to the firmest hand.

As regards nursing, I must say that passengers and seamen have shown themselves equally willing to assist a patient in every way.

Besides the medicine chest, the contents of which, as prescribed by the Board of Trade, I am not going here to criticise, a passenger ship is provided with so-called medical comforts, consisting of certain quantities of wine, spirits, flour, sago, tapioca, sugar, preserved meat, milk, &c. The medical officer is not, however, confined to those comforts, but is at liberty to order a patient anything he thinks necessary from the pantry and galley.

In going through the different systems of the body I shall follow the order of the nomenclature of the Royal College of Physicians of London.

Of *General Disorders* I have to mention in the first place what I used to put down in my medical journal as *languor tropicus.* When the damp oppressive heat of the tropics makes itself felt, a good many people, particularly those who enter the tropics for the first time, begin to suffer from general prostration; they are unable to exert themselves in the least, either physically or mentally; their head feels heavy; there is great sleepiness, so that people may sleep through sixteen hours of the twenty-four, and at all times of the day. Often there is headache; the appetite is always more or less diminished; the tongue is often coated, and a disagreeable taste in the mouth is complained of. The bowels usually are costive.

In little children the general impression may be a rather alarming one.

If the gastric symptoms were more marked I used to put it down as *gastricismus tropicus.* There may be even vomiting. The bowels are either confined or loose. Drunkards are particularly subject to this sort of disorder.

The treatment is in either affection pretty much the same. As a preventive measure the diet must be regulated in accorddance with the climatic change. The liberal meat-diet a cuddy passenger is offered must be restricted, and vegetable food taken instead, and altogether less food than usual must be taken.

Lime-juice, claret, or brandy with iced water are the best drinks. No beer should be taken. The bowels must be kept open nicely, which is best done by an effervescent drink of citrate of magnesia taken before breakfast, or by a good dose of Tinct. Rhei. every day. A mixture of Acid. Sulphuric. with Aq. Lauroceras. was found to do excellent service for those complaints. If the bowels are confined and the tongue coated, it is well to prepare the way by a dose of castor-oil, or Mist. Senn. Co. If the general prostration and the loss of appetite is great, a mixture of Quin. Sulph. (one or two grains) with Acid Hydrochlor. is indicated.

The outbreak of a *contagious disease,* like that of a fire, nowhere produces such a terrible effect on the community as on board a ship at sea. Even if the infected ship run into some port, nobody is allowed to leave it except for the quarantine station, if there be any. In the roadstead of San Vincent, Cape Verde Islands, I saw, for instance, a large French steamer on board which small-pox was raging among the crowd of emigrants she was carrying to South America. There being no quarantine station at that wretched place, she could not get any relief. Therefore it will easily be understood that the first week or so after sailing from an infected port one looks out rather anxiously for any signs of an outbreak of epidemic disease on board. I have experienced this three times, twice after leaving Rio de Janeiro, where yellow fever was prevalent, and once after leaving Melbourne, where measles were just then causing great havoc. But fortunately my ship never became infected. In the first-named place I could not notice any measures being taken against the infection of ships leaving port. In Melbourne a sanitary officer held an inspection of the steerage passengers before sailing. No inspection, however, can of course give a guarantee against infection, since we have no means of detecting a contagious or infectious disease in its state of incubation, and since those diseases have been shown to be capable of transmission by inanimate objects, drinking-water, articles of food, wearing-apparel, linen, etc., which may be taken out only some time after sailing, and thus cause infection of the ship. In this way, no doubt, certain cases of outbreak of infectious disease at sea after a seemingly unusually long period of incubation may be explained. Against the spreading of those diseases the ship itself should be a good guarantee, as it contains no soil in which the poison of cholera, yellow or typhoid fever can vegetate and multiply—the only mode, according to a good many writers, Pettenkofer, for instance, in which those diseases are propagated. For the elucidation of this question a critical study of their occurrence at sea might do much. My own experience in this direction is far too small for that purpose. Leaving out a case of *dysentery* contracted and cured whilst the ship was at anchor, the only representative of that class of diseases I had the opportunity of observing at sea was a case of *typhoid fever* in a ship-boy, about 15 years of age. The disease, no doubt, had been contracted at Melbourne, as it appeared three days after sailing from that port. It took a most interesting and unusual course, the details of which I, however, must refrain from giving *in extenso.* How far peculiarities of the Australian "typhoid poison," how far sea-life, how far treatment may have contributed towards modifying the usual course, I do not venture to define. Most remarkable was a very striking improvement in the middle of the second week, coinciding with the use of Mist. Acid. Carbol (one grain dissolved in equal parts of glycerine and water, taken every three hours). The temperature, which had been very high, fell to the normal standard and remained there for two days; the tongue got moist and clean; the size of the spleen diminished considerably, and the patient felt almost well. Another time, in the sixth week from the beginning, and in the second of a relapse, the temperature was brought down by a single dose of twenty grains of Quin. Sulph. from 106° F. in the afternoon to 97° F. on the following morning, whilst on the five preceding mornings it never had been lower than 102°, and on the one immediately preceding had been as high as 103·8°. From this time the course of the fever became almost intermittent.

Of a good many interesting symptoms in this case I only mention one, a loud tubular breathing, which appeared in front and back of the upper part of the chest, particularly on the right side, whilst there was no dulness corresponding to it, and the normal puerile breath-sound was just audible besides. That tubular sound did not come from higher up, but apparently was caused by the bronchial glands swelling in the same way as the mesenteric glands, and compressing the bronchi, especially the right one.

A regular infection mania has sprung up of late, particularly in Germany. There is scarcely any acute disease which has not yet been referred to infection. Simple diarrhœa, bronchitis, pneumonia, rheumatic fever, and what not have that source in common; and it is only by assigning to each disease a different species of the omnipresent bacteria that those infectionists contrive to bring some variety into their stupendous doctrine. According to it there is, of course, no idiopathic *erysipelas*, but there must be, as *primum desiderium*, some wound or sore, or at least some catarrhal mucous membrane, for the specific virus to penetrate from outside into the body. If this were true, the origin of a case of erysipelas which came under my notice at sea, about forty days after sailing, would be difficult to explain.

Could the "specific bacteria" have followed us all the way from torrid Australia to icy Cape Horn? And if so, why did the numerous cases of wounds and ulcers that were under my hands never show any signs of the same complication, either before or afterwards? The same applies to a case of a *diphtheritic* wound, which became so four days after an operation, and more than one month after sailing, in an extremely decrepit individual. Whilst the infectionists attribute this disease also to the presence of bacteria, I take it to be simply a necrotic process.

Rheumatic fever has been mentioned above as belonging to that comprehensive list of diseases, the origin of which is alleged to be an infectious one. I treated a case of it more than two months after sailing. Where the "specific miasma" should have emanated from on board the ship, I could not possibly make out. It was to the south-east of the Cape of Good Hope that it commenced, the weather being fine at the time, with unsteady, mostly south-easterly, winds, and a mean daily temperature of about 52° F. There were two attacks, each of about a week's duration, the second one following, after a week's intermission, a long exposure to the cold night-air during a theatrical performance on deck. On arriving in Australia the fever had disappeared, but there was still considerable swelling and pain in the whole of the right hand. In the dry Australian climate this also soon disappeared, but after an enormous and sudden change of temperature rheumatic affections recurred. This case may show that under proper care rheumatic fever is not inclined to be worse at sea than on land; on the contrary, whilst this patient, one of the midshipmen, had a relapse in Australia, a climate noted for its dryness, he remained free of it all through the most variable and partly most unfavourable climates on the homeward voyage round Cape Horn, although he was on duty both day and night. A case of *gonorrhœal rheumatism* in one of the seamen, an anæmic individual, proved more obstinate, commencing about a fortnight after sailing from England, and lasting about six weeks, during which time numerous joints of the lower and upper extremities were affected in a sub-acute way. This patient, however, had been laid up before on land by a similar attack even longer (three months) so that this case also does not indicate any unfavourable influence of the sea-climate on articular rheumatism. Nor can I say that I have found *muscular* and *chronic rheumatism* any more frequent at sea than on land; on the contrary, one is astonished to see how comparatively rare these affections are at sea, considering the constant exposure people are subject to.

Of *syphilis* and *venereal affections* in general I have not noticed any peculiarities that might be referred to the influence of sea-life, except that perhaps cases of *gonorrhœa* lasted longer than usual. This, however, may be only due to the irregular life and bad living of the seamen, not to any influence of the sea-climate. That venereal affections are rather common among seamen is a well-known fact. That one sees comparatively little of them, especially of severe cases, at sea, is no doubt due to the supervision exercised at the home-port. Among a total crew of about sixty on board my last ship, I had four cases of *gonorrhœa* in going out, two cases in coming home. *Of soft chancre* I saw none at all; in the two cases of *hard chancre* I saw on the outward voyage, there were also secondary symptoms already present. Of *tertiary syphilis* I came across one case only among the crew, and two among the passengers. One of the latter, that of a woman thirty years old, in which the pharynx and larynx were affected, was for some time of a rather serious character. After an abrupt fall of temperature, accompanied by a furious gale and torrents of rain, in lat. S. 30°, the first attack of extreme dyspnœa occurred, and repeated itself several times. I expected I should have to perform tracheotomy, as the general state of the patient, in consequence of the insufficient respiration, became more and more alarming, although immediate danger from the paroxysms of dyspnœa was very promptly averted by painting the throat externally with Liquor Epispasticus. But fortunately the use of very large doses of Potass. Iod. internally soon averted that necessity too.

Of *tumours* I have not seen any malignant ones at sea. I extirpated three *sebaceous* tumours.

Of *morbus Brightii*, which I regard as a general disease just as well as phthisis, I had an interesting case. The effect sea-life appeared to have on it was not at all such as to encourage one to send patients suffering from that constitutional disease to sea. My patient, a reverend gentleman, fifty-five years of age, not only suffered severely and repeatedly from sea-sickness, but was also very much prostrated by the tropical climate, although, when going out, we had not one real calm within the tropics. Hæmaturia twice made its appearance. Sea-life did not in the least allay the irritable nervous state of the patient.

Of *scurvy* I have not seen any fully developed case at sea. In the case of a third-class passenger, an anæmic woman with a large family, the appearance of the gums and the adjoining mucous membrane might have been called scorbutic. It soon gave way to proper treatment.

On the *nervous system*, sea-life generally is supposed to have a soothing effect, and it may, indeed, in most cases be considered a good plan to recommend a sea-voyage to a client whose brain is over-worked or worried by troubles from without or within. But this remedy does not answer in all cases of that description, especially if the patient does not find pleasant society to cheer him up, and guard him against the other extreme, monotony, or if he finds much cause for anxiety about his personal safety; for the term a "good sailor" has its application in a moral as well as in a physical sense.

As a proof of the soothing or even blunting effect of sea-life on the brain, the fact may be mentioned, that a ship on high ocean is far from being the best place for hard and steady mental work. I believe that the motion of the vessel has a good deal to do with this, the brain being lulled, as it were, into a state of slight drowsiness. Most people, after being accustomed to the motion and the noise connected with it, enjoy a good sleep at sea, although they may not do any work, nor even take any exercise during the day. But, on the other hand, cases are not rare of people losing their sound sleep at sea without any apparent external cause. The most striking of my own cases is that of a very sober-minded, intelligent, and not at all nervous Scotch gentleman, who enjoyed a good sleep at his home in New Zealand, but never once during four months at sea except by the aid of chloral, spirits, or narcotics. It had been the same, as he told me, on former voyages.

Of *sea-sickness* I shall treat in a separate paper. In the tropics two cases of *epileptic* or *epileptiform fits* occurred. The first one was that of a steward who was addicted to drink, and had his liver considerably enlarged. About twelve months before he had had similar fits. They occurred once more in cold weather, the mean daily temperature being 56° F. at the time. The second individual, twenty-one years of age, of consumptive disposition, had only one fit, at night, the first one in his life. These two cases may serve as a hint to people who are subject to vaso-motor neuroses, or in general, to disturbance of the blood-circulation of the brain, and who intend to undertake a voyage through the tropics.

Of *hysteria* I have had several cases. In a rather severe one with dysmenorrhœa and severe spasms of the pharynx and larynx, I have not seen the slightest benefit from a sea-voyage lasting 118 days; on the contrary, that lady was in such a weak state on landing that she could not move to the place of her destination for about ten days, and there too continued very poorly. *Neuralgia*, mostly in the face and head, was not uncommon.

In a case of *melancholia* tending to *chronic dementia*, of a gentleman about twenty-eight years of age, formerly a squatter in New Zealand, the patient seemed to improve a little in body as well as in mind, the constant company on board a ship having a beneficial effect on the latter.

The physiological effect of long sea-voyages on the *eye* is an improvement of the eye-sight, if there was short-sightedness in consequence of previous close work. Most part of the time one spends on deck, where the eyes are straying over the boundless ocean. Only if one is much given to reading at night time his eyes may be spoiled by the bad light. Of diseases of the eye I only saw some cases of *catarrhal ophthalmia* in the cold weather. A seaman lost one eye by thrusting his pocket-knife into it.

Notwithstanding the great humidity of the sea-air, several cases of accumulation of hard, dried-up cerumen in the external meatus came under my notice, also two cases of *otorrhœa.*

The *circulatory system* does not, under ordinary circumstances, present anything very remarkable. As has been shown in the last paper, the pulse in the later part of a long sea-voyage is somewhat less frequent. In persons who, as is generally the case with consumptive invalids, come on board with an accelerated and excitable pulse, that decrease is much more remarkable. This effect I attribute partly to the quiet life and the want of exercise on board ship, partly to the soothing and relaxing influence of the sea-climate, which, in my opinion, is principally due to its humidity.

It is a well-known fact that *aneurisms are of* comparatively *frequent occurrence among seamen.* The most interesting case of aneurism (of the *arcus aortæ*) I had under my care, and made the post-mortem examination of, was that of a seamen. Also among soldiers the frequency of aneurisms has been remarked and attributed to the tightness of their uniforms, together with hard marching whilst carrying a heavy burden on their back and shoulders. For seamen none of these circumstances can come into consideration. We have, therefore, to look out for another explanation. There is first that relaxing effect of the sea-climate, particularly in the tropics, on the vascular system, which is unmistakably evidenced by a remarkable disposition to hæmorrhage at sea. Secondly, as has been detailed in a previous paper, the life of a seaman as a rule is a most irregular one, and his food at sea bad, so that when on land he is induced to indulge in excesses, particularly in drinking. That alcoholism, acute and chronic, effects important changes in the circulatory system I need not remind anyone. The circumstances enumerated just now, as well as the frequent occurrence among sailors of syphilitic dyscrasia, however, I consider to be only predisposing ones; for other classes of people who live under similar circumstances, in a relaxing sea-climate, with bad food, addicted to excessive drink, imbued with the syphilitic virus, do not show such a large proportion of aneurisms as is found among sailors. We must, therefore, to explain this frequency, look somewhere else for the exciting moment. It is to be found in the occupation of the seaman, which in great measure consists of *climbing up the rigging* and especially *pulling at ropes.* One has only to watch the rows of men at the latter work in order to understand its effect. As a rule, in order to keep time, one sings out first—a pull – then the chorus falls in—a pull—and so on. The singing means a prolonged, the final pull a sudden and violent, expiration, by which, as if by a voluntary concussion, the volume of the thorax is reduced to its utmost. The pressure exercised on its contents must not only impede the centripetal circulation, but also give at first (during the singing out) a gradual, and at last (during the pulling) a jerking impulse to the blood in the aortic system within the thorax, by compressing the heart and the aorta. After the power of expiration has been tasked to the utmost, a deep, hasty inspiration follows. Immediately the venous blood, kept back until then, rushes in and expands first the right heart, and then, having gone through the lungs, the left heart and the aorta. The latter now suffers the other extreme; it is abnormally expanded. Such a violent change between compression and expansion is in time sufficient of itself to impair the texture, and with it the elasticity, of the walls of the aortic trunk, or, if this has already been brought about by the predisposing circumstances mentioned, it may at once cause an aneurism of the aorta in some place or other.

In the extra-thoracic arteries this movement makes itself the less felt the greater their distance from the aortic trunk. But here the same act of pulling brings with it another, simply mechanical, movement, which it is easy to imagine may become the exciting cause of aneurism. The men usually stand at the rope in a semi-erect, cowering position, with their hip and knee-joints more or less bent, whilst the arms, on the contrary, are stretched. Now comes the pull, and those joints are suddenly and violently stretched, the arms as suddenly and violently bent. In either case the respective arteries must suffer by the vehemence of those movements repeated innumerable times. Moreover, part of the blood in those arteries is expelled by the strong and sudden contraction of the muscles from those parts of the vessel which are surrounded by them, and accumulated in portions where there are no muscles around it, as in the *fossa cubitalis* and *poplitæa;* which accounts for the comparative frequency of aneurisms in those places.

I have already mentioned that I observed a remarkable disposition to *hæmorrhage* at sea, which I explain by the relaxing influence of the sea-climate, particularly the tropical one, on the blood-vessels. It must, however, be stated that most of my cases occurred on the voyage out, when the majority of the passengers were invalids. Nevertheless, the frequency of their occurrence is sufficiently remarkable to give a warning to people disposed to hæmorrhage of any kind who intend to go to or through the tropics. Here is a list of my cases :—

Hæmorrhage from the nose	1
„ from the respiratory organs . . .	11
(among them two very serious, and one fatal one)	
„ from the organs of digestion . .	3
„ from the kidneys	1
„ from the uterus	1
„ from an abscess	1

In all 18 cases, representing a very respectable percentage of our small community.

The *digestive system* is the one most influenced by sea-life, unfortunately more often for the worse than for the better. To begin with its good influence—a passenger in the beginning of a long sea-voyage, after sea-sickness is over and he has become acclimatised to sea-life, gets a most wonderful appetite, considering he does no work and has little or no exercise. Generally the whole credit for this remarkable improvement, particularly welcome to hitherto dyspeptic people, is given to the "bracing sea-air." Leaving the precise definition of this property of the sea-air and its influence in this particular case alone, I believe there are several other circumstances to which those people are indebted for their good appetites. The chief of these is the great change, which rarely fails to impart fresh vitality to the body at large, and in particular to the digestive system ; then the preceding sea-sickness, which, it may easily be imagined, gives one the appetite of a convalescent ; and lastly, the motion of the vessel, which, in my opinion, after the contrary effect is over, in great measure counteracts the want of occupation and exercise on board a ship. After a drive or a ride we feel a keen appetite, although our exercise may have been very little in an active way, for during it there is a *passive* exercise, which with many people, especially invalids, is quite enough of a tonic, particularly if taken when the air is in motion and the temperature rather low. The tonic effect of sea-life, as analysed just now, may even prove too powerful for people with very weak constitution and digestion. Such cases, however, are rare.

The opposite condition from that just described is much more frequent, and on a protracted sea-voyage pretty general, namely, that after a certain time that *stimulus* loses its effect; the appetite is diminished, and even a state of actual indigestion obtains. As before the change, so now, the monotony of life and food is the principal cause of the person's state. It is an interesting question, but one difficult to solve, whether and how far, on a voyage round the world like my last one, the reversion of day and night which, although gradual, is yet quite quick enough, has a disturbing influence on the functions of the digestive system. When sailing with a fair wind in high latitudes one loses daily twenty minutes or more in the twenty-four hours, *i.e.* an hour in about three days.

Thus the hours for the regular meals are getting displaced. If the hands of the ship clock were not interfered with, *i.e.* put forward according to the then position of the sun, they would, as the chronometers really do, at that rate of easting, already after twenty days show 3.30 at breakfast instead of 8.30; 7.30 at tiffin (luncheon) instead of 12.30; 11 at dinner instead of 4. With no other organ does "custom become a second nature" to a greater extent than with the stomach. Mine makes me feel this quite unmistakeably as soon as I exchange one country for another where, without any difference of longitude to speak of, the time for the regular meals is different from that to which I have been accustomed. On a voyage round the world the stomach experiences a far greater difference together with a continual change of the day-time.

Indigestion is one of the most frequent complaints at sea, particularly among seamen. After what has been said of their life and food this will not be wondered at. There does not appear to be much accommodating power on the part of the digestive system of a seaman; for the few old seamen (quartermasters and petty officers) one meets with are the very ones who complain most of symptoms of chronic indigestion. Often also immoderate use of spirits helps to bring on chronic catarrh of the stomach and the intestines. The symptoms of *languor* *tropicus* and *gastricismus tropicus* have been already described. Not a few cases of *acute gastritis* with or without fever, in the latter case accompanied by sore throat, also came under my notice. Whilst in gastric fever on shore I have observed as a rule a remarkably infrequent and slow pulse, which I believe to be due to reflex-action from the irritated vagus and solar plexus, I have not noticed anything of the kind at sea. This, however, no doubt is to be accounted for by none of my patients being above ten years.

Nothing is more common at sea than *constipation,* which sometimes is very obstinate. Want of exercise, monotony of life and diet, are sufficient to explain it. The reversion of day and night-time may have to do with it too. *Diarrhœa* is likewise of frequent occurrence, particularly in hot weather. It may alternate with constipation. Only one of my diarrhœa cases, that of a ship-boy, was obstinate.

Sore throat, with or without fever, is common at sea. A remarkable fact is the great frequency of *caries of the teeth,* and consequent toothache in the case of the seamen; this is easily explained by the horrid and extremely monotonous food they have to bite. But since first-class passengers also generally complain greatly of their teeth getting bad and aching, there may be something in the sea-climate to account for it. Several cases were complicated by gum-boils and ulceration of the gums.

No diseases of the *urinary system* came under my notice, except those already mentioned, viz., a case of morbus Brightii, with hæmaturia and gonorrhœal affections.

Of pelvic peritonitis, anteflexion of the uterus, dysmenorrhœa, menorrhagia, pregnancy, single cases only were observed, and those without any peculiar features traceable to sea-life.

Inflammation of the cellular tissue, resulting in suppuration (*abscess*), was rather frequent, and it is to be remarked that all the cases, mostly spontaneous ones, occurred exclusively in seamen and third-class passengers, whose salt food was probably the cause of their predisposition.

Next to the digestive the *cutaneous system* is most prominent in the physiology and pathology of sea-life, particularly in hot climates. These are the two systems principally concerned in the process of acclimatisation, the skin, together with the lungs, being as has been pointed out in the last paper, more in an active, the former in a passive, way. At sea, within the tropics, the *perspiration* is very much increased, most excessively so in the doldrums (equatorial calms). The heat and perspiration make sitting at meals most uncomfortable, and everybody is anxious to get away back on deck from steaming dishes as soon as possible. People get remarkably thin in consequence of the great and continual loss of fluid in the way of perspiration, and in consequence of diminished appetite. The thirst, however, is not particularly increased, the air being almost saturated with water, so much so that everything, books, clothes, and particularly leather things, gloves for instance, get covered with the most luxuriant mildew. Crystals of hydrate of chloral melt away very quickly. Seidlitz powders for the same reason will not keep. It is this high degree of humidity which makes the tropical heat so very oppressive. I have been exposed to a temperature more than twenty degrees higher than the highest I have observed in the tropics at sea; yet I found the former less uncomfortable. The evaporation in the tropics at sea cannot nearly keep pace with the perspiration: one is as it were in a continual Turkish bath.

A frequent consequence of the excessive perspiration, particularly with children, is the outbreak of *miliaria rubra* and *intertrigo*. I have also seen the axillary sweat-glands get inflamed and very tender. *Impetigo* in young individuals is also nothing unusual in the hot weather, generally following on a severe indigestion or *gastritis*. Another eruption, the outbreak of which I observed exclusively in the tropics, was *boils*. As regards the class of people affected, boils as well as *eczema* followed the same rule which has been noticed in regard to abscess.

In the beginning of the voyage several fresh cases of *acne* appeared; old ones got worse, although at sea—at least, on board a sailing-vessel—the ducts of the sebaceous glands are no longer choked with particles of coal and dust as in London. I do not, however, believe in this mechanical ætiology of acne in all cases, or rather I consider that cause as only of secondary importance, the principal cause being a constitutional sluggishness of the function of the skin, and in particular the sebaceous glands. There is an accumulation of effete matter in the blood which the skin is slow to eliminate. The secretion accumulates in the sebaceous glands, and thereby leads to inflammation. I contend for a similar origin of several other skin-diseases, and consider it to be analogous to that of tuberculosis in the internal organs, such as the lungs. This may seem a very old-fashioned view, which I however hope to develop more fully somewhere else. And now for the explanation of acne getting worse at first at sea. Two circumstances are to be taken into consideration: first, increase in the process of elimination in consequence of the change for the better, and especially the beneficial influence of the pure sea-air on the constitution or *κράσις*. The blood now throws off the effete matter more actively. In the later part of a sea-voyage, on the contrary, acne is observed to get decidedly better. The second cause of its getting worse at first is the profuse perspiration in the tropics: the sweat-glands pour out so much fluid, that the secretion of the sebaceous glands has too little, and becomes hard, and therefore difficult to excrete. An analogous process is the accumulation of cerumen, which I have mentioned in its place. The epidermis also, particularly at the tips of the fingers, is observed to get thickened and horny.

Of *erythema* I saw several cases, of which two were symmetrical on the lower extremities, the one at the ankles, the other along the tibia. A case of *urticaria* in a boy of ten years of age was distinctly caused by eating preserved lobster the evening before its outbreak in the right hypogastric region and the groin. It disappeared within twelve hours.

One might take the frequency of skin-eruptions at sea as evidence of an irritating effect of the sea-air, due to its being impregnated with salt; but I should not ascribe any such importance to this circumstance. The different cases of skin-disease enumerated above, so far as they are not the result of profuse perspiration, are best explained, in the absence of any local irritant, on the same principles that have been laid down for acne. These principles must come particularly into operation with people who, like the crew and third-class passengers, live almost entirely on salt provisions.

Whilst exposure to the sun in the tropics caused the skin to come off, often in large patches, exposure to the cold in the far south caused *chilblains* in a good many people, particularly in female passengers from Australia who never were accustomed to it.

Lastly, I may mention the *parasites* which came under my notice at sea. Whilst to the zoologist there is no study more interesting than this class of organic beings, to our profession they have comparatively little scientific interest. I therefore only give a list of those I met with :—

Fleas, not particularly numerous and obtrusive.

Crab-lice, comparatively frequent, therefore "blue butter" in large demand with the sailors.

Tænia, one case in the ship-butcher.

Lumbrici, one case from Australia.

Microsporon furfur (*Tinea versicolor*), one case, quickly cured by a lotion of carbolic acid.

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ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

BY C. B. FABER, M.D.,

Late Resident Medical Officer to the German Hospital, London.

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IV*b*.—ON SEA-SICKNESS.

> "The best of remedies is a beef-steak
> Against sea-sickness; try it, sir, before
> You sneer, and I assure you this is true,
> For I have found it answer,—so may you."—BYRON.

SEA-SICKNESS is to the general public the most familiar and formidable phenomenon in the pathology of sea-life. It is not, therefore, to be wondered at its having called forth a voluminous literature of its own, which I must confess I have not yet had time to study, else I might here give a goodly list not only of remedies recommended for it, but also of *theories on the nature* of it. Only one of the latter I happened to come across very recently in the *Lancet*. According to it sea-sickness is caused by "the pitching of the vessel rather than the rolling," the abdominal viscera suddenly falling and the muscular parietes not giving them due support during the act of falling. If this were so, a most simple and, I dare say, infallible remedy for sea-sickness must be a broad belt put on tightly around the abdomen. The benefit, or otherwise, such a "sea-sickness belt" would afford might be taken as a proof *ex juvantibus* for or against that theory. As regards "the pitching of the vessel rather than the rolling" causing sea-sickness, I must say that I have found people disposed to become sea-sick, or already so, generally are more afraid of the rolling than of the pitching motion, since they find they suffer more by the former. The best instances of this I have seen were in the Bay of Biscay, when there was not much wind but a "heavy Atlantic ground-swell," rolling in large, flat waves across the course of the vessel. A case like this is one of rolling as pure—*i.e.*, with scarcely any pitching—as one may wish for, and yet sea-sickness may rage on board more severely than ever. A conclusive practical trial of the "sea-sickness belt," which I here earnestly recommend, having not yet been made; I was inclined at the outset to give more credit to another theory, according to which sea-sickness is caused by the action of the unaccustomed passive motion, be it pitching or rolling, on the brain, which gets into a state of anæmia by its arteries and arterioles contracting reflexly. Thus sea-sickness, like epilepsy, would belong to that class of nervous disorders called *vaso-motor neurosis.* This theory seems to be supported by the fact, which may easily be observed by anybody who is not himself affected, that some time before the outbreak of sea-sickness, even before its approach is dreamed of by the guileless victim, the ears are seen to become deadly pale and white. My belief in this theory, however, has been materially shaken by the failure of what one should think a crucial test I put it to, of which more below, where I speak of the treatment of sea-sickness. Another theory, I think I have heard of somewhere, attributes the cause of sea-sickness to disturbance of the cerebral circulation too, but in a different way, namely, according to the law of gravitation. I recapitulate it from memory and, therefore, cannot guarantee its literal correctness.

During the downward motion in the act of pitching, the flow of the blood *from* the brain is accelerated, there being as it were, a sudden slipping or falling down of the blood-column. On the contrary, the flow *to* the brain is retarded, repelled as it were. In this way sudden anæmia of the brain is caused. The reverse condition obtains during the upward motion of the vessel. This irregularity of the cerebral circulation is the cause of sea-sickness. Apart from other considerations the same objection is to be raised against this as against the first-mentioned theory, namely, that sea-sickness occurs pretty much the same, whether the vessel is pitching or rolling, whether a person is standing or lying down, whilst according to the last-mentioned theory it must be obviated by a lying position across beam. If I dare venture to give a hypothesis of my own of the nature of sea-sickness, I should suggest that it probably consists in a molecular disturbance of the brain-substance. The brain is, in a rather unaccustomed and uncomfortable way, being rocked to and fro, upwards and downwards, regardless of its principles of equilibrium, formed on *terra firma,* and hence arise the giddiness, vomiting, in short, all the horrors of sea-sickness.

On a long voyage sea-sickness has not, in the eyes of the passengers, that paramount and terrible importance it has on a short passage across the English Channel or the German Ocean; in the former case most of them submit patiently to it as an inevitable tribute to the grim rule of Neptune, which, being once paid, makes the pleasures of sea-life only the more enjoyable, as a convalescent is most sensible to the charms of health. Yet, although all who have crossed the Channel think they know sea-sickness quite well enough from their own experience, it may not be out of place to give in addition the results of my observations of the subject; as only on a longer sea-voyage, like that round the world, has one full opportunity of observing the whole of its course and peculiarities.

The *disposition to sea-sickness* is not so general as one might think; at least I have met with a good many people who said they had never been subject to it. In this respect I noticed a remarkable difference between English people and Australian colonists. That disposition appeared to be less not only with such of the latter who had made the voyage to their new home at the antipodes many years ago, but also with such of them as were born in Australia and had never been to sea before. As a rule, thin people show less disposition than stout ones. The agonies of the latter surpass anything met with in the former. So consumptive people are less subject to sea-sickness, and, although on my last voyage I had a whole ship full of invalids of this description, I did not see any of the serious consequences of sea-sickness that might have been presumed, such as rapid wasting, hæmorrhage, &c. The absence of the latter was the more remarkable, as I subsequently had to do with a sort of hæmorrhagic epidemic among consumptive as well as non-consumptive persons.

One may resist sea-sickness for some time, even when the sea is rough, but at last, perhaps after several days only, one succumbs to the gradually accumulating effect of the unaccustomed motion. Some people may resist it altogether in a sailing vessel, and even in a good large steamer, but still, after an almost life-long immunity they may become victims in one of those wretched little steamers, for instance, which trade between Tasmania and Australia. Such was the fate of an English general who on his voyages to the West Indies, China, the Cape, and Australia, never had been sea-sick, such the fate of several friends of mine who had hitherto been boasting of their immunity. Very few people, however, when first afloat remain unaffected. Some withstand sea-sickness so far that they do not get actually sick, but although keeping up against it, they feel rather " queer," " seedy," and squeamish, and have not only little or no appetite, but even a downright horror of the regular meals, and of remaining for any length of time in a room down below. This is the *lightest degree of sea-sickness*, not, however, the most pleasant one. Far better to get rid of a good portion of squeamishness and bile by a short outburst, immediately after which I have often seen people feel all right and even enjoy a hearty meal. The same process may repeat itself for several days. It is, therefore, advisable not to suppress, but on the contrary to provoke that outburst. The third degree of sea-sickness, which is characterised by combined vomiting, horror of any food, and utter prostration, I need not describe. That prostration, like the sickness, is at first of a nervous origin, and soon gets an additional source from want of food, as is shown by a correspondingly more or less rapid loss of flesh and body weight. This may become a really serious affair, and, although I know of deaths from sea-sickness only by hearsay, I should not, after what I have seen myself in the way of exhaustion caused by severe sea-sickness, especially with females, consider such a contingency at all impossible.

The *duration* of sea-sickness, as its intensity, depends upon external as well as on individual circumstances. I have seen it last for weeks. On a voyage to Brazil and the River Plate in a mail-steamer, a stout Scotch lady could not for that reason make her appearance at the regular meals for some weeks, although from off Cape Finisterre the sea was no longer rough; but she had to retire afresh whenever it got somewhat rough again. It is a remarkable fact that some people are unfortunate enough to become sea-sick again and again, not only after having been away from sea for some time, but also on the same voyage. Of England's greatest naval hero, Nelson, this is said. Mr. Darwin, in his classic *Journal of Researches*, &c., says, "If a person suffer much from sea-sickness let him weigh it heavily in the balance before undertaking a long voyage. I speak from experience; it is no trifling evil cured in a week." It is, however, rare that subsequent attacks on the same voyage are equal in severity to the first one. The majority of people fortunately get over it with the first attack, and, although this may not have spared them any of the horrors of sea-sickness, they subsequently feel a bracing, stimulating—rather than a sickening—effect from a rough sea.

Preventive measures against sea-sickness have been recommended in great number. I usually recommend a hearty meal and drink (claret), and afterwards a recumbent position, in which the eyes should not be shut, but engaged in reading. If it were true that sea-sickness comes from "a sudden falling of the abdominal viscera," this falling, and consequently the outbreak of sea-sickness, must be increased by filling the stomach with a hearty meal. But just the contrary is observed. The second theory is more probable: during digestion the circulation and in particular the flow of blood towards the brain is increased. The latter is antagonistic to that spasmodic anæmia of the brain of which sea-sickness is the expression.

Preventive measures may be all very well in short trips, but on a long voyage I do not believe in suppressing sea-sickness. As I have already remarked, a good, downright outburst generally relieves that squeamishness and seediness which, in people disposed to sea-sickness, cannot, I believe, be suppressed by any means. I consider narcotics, chloral and chloroform, particularly out of place for that purpose. Instead of suppressing sickness they often have a direct nauseant effect, and, at any rate, after their effects on the brain are over, leave the sufferer in a state of increased squeamishness, and altogether only protract the attack, which without them might have been a very short one. Starting, on the one hand, from that theory of sea-sickness according to which it is a vaso-motor neurosis, and on the other, remembering the fact that nitrite of amyl has a most remarkable action on the blood-vessels of the head and brain antagonistic to that spasmodic contraction, the supposed cause of sea-sickness, I thought that it might, not to say *must*, prove an excellent remedy for sea-sickness ; I consequently took a good stock with me. But it signally failed. Generally, its inhalation was immediately followed by vomiting; but without the usual flushing of the face. Palpitations of the heart were complained of in several cases. Once with a nervous female its administration was followed by a slight fainting fit—a not unusual occurrence.

The best remedy for sea-sickness, particularly squeamishness, was in my experience oxalate of cerium, which I gave in two-grain pills. Only if the vomiting continue to an alarming extent, I find opiates, chloroform, or chloral, required. Opium deserves the preference over morphia. The diet during the period of vomiting had best consist of slops and claret, or brandy with iced water. The patient, who, as a rule, is most unwilling to move at all, should be taken upon deck and made to stay in the open air for at least some hours of the day. Ladies are especially apt to neglect this prescription, and I believe the greater length and the more weakening effect of their sickness to be partly due to this circumstance.

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ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.

ON THE INFLUENCE OF SEA-VOYAGES ON THE HUMAN BODY, AND THEIR VALUE IN THE TREATMENT OF CONSUMPTION.[1]

BY C. FABER, M.D., OF STUTTGART,

Late Resident Medical Officer to the German Hospital, London.

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V.—ON THE INFLUENCE OF SEA-CLIMATE AND SEA-LIFE ON THE CONSTITUTION IN GENERAL, AND ON THE HEALTH OF SAILORS AND PASSENGERS, PARTICULARLY IN CONSUMPTIVE INVALIDS.

ORIGINALLY I intended to begin this chapter with a sketch of the principles of the climatic treatment of consumption. But I found that I had more to say on this subject than could be conveniently compressed into a moderate compass, and therefore will treat it in a separate paper.

The discussion of the physiological and therapeutical effects which sea-climate and sea-life have on the constitution has been allowed to stand over from the fourth chapter to this place, as it is intimately connected with the question of the value of sea-voyages in the treatment of consumption.

Putting aside local differences and peculiarities, the qualities of *sea-climate,* whether at the sea-side or on the high seas, of most interest to us are: first, a relatively *large* amount of *atmospheric moisture.* Taken by itself, and leaving out other influences to be mentioned later on, which have a greatly modifying effect, moisture, together with a *high atmospheric pressure,* such as obtains at the sea-level, has a relaxing, or, from a therapeutical point of view, a sedative effect. At the same time evaporation from the skin and lungs being less under their influence, the secretions become more fluid; and a viscid sputum, for instance, which an invalid has great trouble in bringing up, becomes more watery and easily expectorated at the sea-side. But for the same reason catarrhs are more frequent and more obstinate than in a drier climate. Leucorrhœa, for instance, is a most common, one might say endemic, disorder in certain parts of Western Europe which have a sea-climate.

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[1] We are glad to be able to present to our readers the continuation of Dr. Faber's valuable papers on this interesting subject after a prolonged but unavoidable interruption, circumstances having rendered it impossible for him to continue the series at the time the break occurred. We believe these papers will be especially acceptable at this season when the question of what is to be done with a consumptive patient is so frequently put to the practitioner.—ED. *Pract.*

Not only do catarrhal secretions flow more freely, but according to Ludwig, the eminent physiologist, carbonic acid is more freely exhaled from the lungs in a moist atmosphere.

Another characteristic of the sea-climate is its *equability*. The annual as well as the daily range of temperature is comparatively small. This is another element in the relaxing or sedative influence of the sea-climate.

The weather, on the contrary, is more unsettled in a damp than in a dry climate, and the intensity of light is less.

When combined with a *high air-temperature,* the effect of a damp climate is relaxing and oppressive in the extreme. Under such conditions the machinery of the body is working at its lowest rate,—the steam as it were being at the lowest possible pressure in the living engine.

The profuse perspiration evaporates so slowly from the surface of the body, that the body is constantly bathed in it, and the usual cooling effect of evaporation is greatly diminished. This condition is experienced in its purest form and greatest intensity in an equatorial calm on the high seas. But one may get at least a faint idea of it even in European waters, when there is a succession of hot and calm days, such as I have seen in the English Channel, for instance. There is therefore good reason for fashionable seaside places, with a climate like that of the south coast of England, becoming crowded only towards the latter part of autumn.

A climate combining much atmospheric moisture with a *low temperature*, such as one generally gets only too good an idea of off Cape Horn, has an effect by no means agreeable nor particularly desirable for an invalid. Damp air is a better conductor of heat than dry air; the former, therefore, at the same temperature feels more cold and chilly than the latter. It produces a most uncomfortable impression upon the sensory nerves of the skin, or rather the specific nerves, for such I believe them to be, which transmit the perception of external temperature to the brain, and to which I assign a most important part in the production of those effects upon the whole system which change of climate induces. These nerves dislike, if we may use the term, the impression thus made upon them, and they greatly prefer the sunny winter of Mentone or Egypt to the dull and damp one of Venice or Pau.

Next to the moisture and temperature the motion of the air, in one word the *wind*, is the most important point in determining the physiological and therapeutical character of sea-climate. Supposing the atmospheric temperature to be an ordinary medium one, much atmospheric moisture, with a moderate atmospheric temperature, diminishes tissue-change in the body, but air in motion has the contrary effect of increasing it. All winds, however, have not the same physiological action. There are strong and light, cold and hot, moist and dry winds, with all their gradations and combinations. They all come more or less into consideration on a long sea-voyage, like that to Australia. I cannot here particularize the action of each, and it may suffice to speak of the effects of the ordinary *sea-breeze* which everybody knows from his own experience. In the face of a fresh sea-breeze certainly no one will feel a relaxing effect from the sea-climate; there are, on the contrary, a good many persons, particularly ladies and invalids, that find it "too strong," too stimulating and exciting. The symptoms of this over-stimulation resemble those of the "acclimatisation fever" I have described along with the climatic treatment of consumption.

The action of the sea-breeze, or of any other wind of ordinary temperature, moisture, and strength, is a double one: in the first place, it causes increased production of body-heat by the reaction which occurs from the great cooling it occasions both by directly abstracting heat, and by increasing the evaporation. Secondly, it stimulates the nerves of the skin, particularly those of the head, and thereby communicates an increased tone to the whole nervous system, so that one feels light and buoyant under the influence of a fresh sea-breeze.

This stimulating effect of the sea-climate, which makes itself felt principally in the nervous and digestive systems, may be much increased by sea-baths, if taken judiciously, particularly as regards duration.

I believe it is the happy mixture of soothing and stimulating qualities in the sea-climate that makes so many people, especially invalids, gain weight, strength, and spirits in a most remarkable way under its influence. Its effect is shown by the microscope as well as the balance, for Messrs. Malassez and Picard have found the number of red-blood corpuscles to be increased by one-sixth after a stay at the sea-side. I will not venture to reckon how many milliards of corpuscles this increase may amount to.

As a matter of course the air of places which are resorted to for climato-therapeutical purposes should above all be *pure*. In this respect, however, many of our sea-side places leave much to be desired. Besides unsatisfactory local conditions, the land-breeze in many cases comes over an unhealthy back-country, wafting foul rural and urban emanations towards the sea-shore, and the sea-breeze also may be polluted by the emanations from decomposing animal and vegetable matter, which at low tide often lies exposed in large quantities on the beach or on outlying sandbanks. For the first reason a small island, for the second a steep shore, with just beach enough to admit of bathing, is preferable for our purpose. It is, however, not only at the coast that one may be molested, and his health injured by organic emanations. I have also smelt them distinctly on the ocean, particularly during calms in the tropics, and in the Sargasso Sea.

I do not think that the increased quantity of oxygen, in consequence of the high atmospheric pressure, or the trifle less carbonic acid which we find at the sea-level as compared with higher elevations, has any great physiological or therapeutical action; nor do I attach so much importance as many have done to the admixture of salt with the sea-air as having a resolvent action on the secretion of catarrhal mucous membranes. In this respect, as we have seen already, the moisture of the sea-air is of much more importance.

Now if we take all those different components of the sea-climate, their various combinations and modifications as effected especially by differences in the moisture, temperature and motion of the air, we may form some idea of what a complicated therapeutical agent a long sea-voyage, say to Australia, must be in respect of climate alone; much more complicated, indeed, than any other kind of climatic treatment of consumption on *terra firma.* There is in the case of such a voyage not only the most radical change of life, but also a great variety of different sea-climates, in quick and irregular succession ; from the temperate or even cold to the very hottest, and *vice versâ.* In the same manner on such a voyage the character of the wind, the amount of atmospheric moisture, and the other qualities of the sea-climate change frequently and often abruptly.

It would be futile to attempt to determine the effects on the body of each climate during a long sea-voyage. Suffice it to refer, on the one hand, to the physical character of the climate of different oceans and latitudes as given in the first chapter, and on the other to their respective physiological and therapeutical effects as just explained.

It is, however, not only the climate that influences the health of people at sea, the hygienic condition of their ship (see Part II.) and their mode of life, also come into consideration. Therefore, under the same climatic conditions the influence of a sea-voyage on the constitution may be very different with different individuals and classes of people. So this influence, or in other words, the general state of health, the morbility and mortality may be expected to differ, when we compare seamen with passengers, ordinary emigrants with first-class passengers. Such a comparison, based on statistics, I believe to be the best way of approaching a question which is of fundamental importance for our present subject: viz.—*Is sea-life a healthy one ?*

(1.) *The Health of the Sailor.*—The notion that the sailor's calling is a particularly healthy one is very common, especially with people whose notions are based more on theory than on practical experience. I have heard one of the most famous physicians of our day advise the parents of a delicate and strumous-looking boy to make a sailor of him. But from what I have seen of a sailor's life in the mercantile marine, I should consider it a rather hard trial to a weak constitution, and one involving the risk of its breaking down completely instead of being strengthened. Take the case even of a midshipman, whose duties are much the same, but whose fare, accommodation and social position are much better than those of an ordinary seaman; and yet it appears a doubtful way of strengthening the constitution of a weakly boy to keep him on watch for four hours every night in every sort of weather, and moreover to have what he has left of a night's rest liable to be broken at any time by the call: "All hands on deck!" As has been shown in the second chapter, the seaman's calling is characterized by irregularity, periods of the hardest work, through days and nights of the worst weather, alternating with periods of comparative idleness. Voyages too often last longer than is good for the constitution, or the intervals between them are too short for getting refreshed in body and mind. Nor is the stay on shore always taken advantage of in the right way; on the contrary, body and mind in many, if not in the majority of cases, are more injured than benefited by it.

An officer's life is under ordinary circumstances more regular than a seaman's; still he too has, of course, to face every sort of weather, and he takes his four hour's night-watch. When I look back I can scarcely say that I have seen any more "pictures of health" among the numbers of officers of the mercantile marine I have met with than among the same number of city clerks.

Still less does the ordinary seaman give the impression of his calling being a particularly healthy one, either to the medical officer of the vessel, who is specially acquainted with his manifold constitutional and local ailments, or to a casual observer. A crew on the whole is generally found, even in first-class ships, to present a stunted, sallow, depressed appearance, for which a sufficient explanation is given in a former chapter (Part II.). It is a remarkable fact, which struck me very early in my sea career, that one sees so very few seamen of advanced age, say above forty. At that age certainly the prime of a man's life scarcely ought to have passed as regards physical strength and ability for hard work. Although most seamen are unmarried, yet their pay (about three pounds a month) is too low to enable them to retire after a number of years from sea-service and live on their savings. Sailors, moreover, are as a rule as much averse to saving as to commencing some other occupation on land. The only explanation of the fact I have mentioned must therefore be that the average duration of a seaman's life, or at least of his continuing to be an able-bodied seaman, is a comparatively short one.

The English merchant fleet, although a matter of private enterprise, is of pre-eminent national importance. It not only enriches the country by importing the products from all parts of the world and exporting in exchange her manufactures, but it also carries the English name and English influence into the remotest parts of the world where a man-of-war seldom, if ever, makes its appearance. It was the English merchants who conquered India; it is the English merchant fleet that connects the distant parts of the great empire on which the sun never sets. England may well be proud of her merchant fleet. It deserves well of her. But the question is, Does England in return do her full duty towards her merchant fleet? In particular, has legislation done everything that might be expected not only for the shipping interest at large, but also for the individual seaman? His is certainly no small share in the merit, as I have just pointed out, and it is hardly earned too. It is not, however, my business, to advocate his cause in any other than a sanitary respect. Is he, then, sufficiently provided for in that respect, and in the case of his falling ill and getting disabled by disease, accident, or advanced age?

These are, I believe, questions well worthy of public attention. As far as the ship's hygiene is concerned, they have been already answered in the second chapter. Here I would further point to a material defect which stands in the way of the sanitary improvement of the merchant marine.

Sanitary statistics are most valuable as indicating the direction in which improvement is needed. Now, as Mr. J. Simon informs me, there are practically no such statistics of the health of the merchant marine. The attempts that have been made towards this end appear to be more or less unreliable and contradictory. This will always be so as long as there is no strict organisation in force for taking these statistics. And even then great difficulties will stand in the way.

The merchant marine is scattered all over the world without any organisation and satisfactory control as to whereabouts and sanitary condition whilst abroad. A ship may be away from home for years trading between foreign countries, she may pass into foreign hands, she may be lost and never be heard of. This want of control is not, however, the principal objection; still more in the way of sanitary *statistics on the health of the merchant marine* stands the circumstance that the majority of sea-going vessels have no medical officer on board to make those statistics; and even where there is one, the "health log" is in the hands, not of the medical officer, but of the captain, from whom, of course, one can expect nothing but an entry of the number of deaths, without even giving their causes, not to speak of any morbility statistics.

Valuable information on the mortality and morbility and their causes in the merchant marine might be got, if each medical officer, where there is one on board, could be made to keep complete lists thereof, and to deliver or send them in at the end of the year. From the respective portions of the merchant fleet a calculation might then be made on the health of the whole. The total result, however, arrived at in this way no doubt would be too favourable, as it would be based almost exclusively on the mortality and morbility in first-class steamers and sailing vessels. Thus just that class of vessels which stand most in need of sanitary improvement would escape the control by statistics. For the same reason of their being too favourable, the health statistics of the *navy* are no measure for the health in the merchant marine. The men of the former are a picked body; their accommodation and food are, generally speaking, better; their occupations whilst at sea more regular; their life on shore less licentious; in short, their discipline is better than that of merchant seamen. There is on board every man-of-war at least one medical officer. This latter circumstance contributes materially to save a good many lives, particularly in cases of accidents.

There is, on the other hand, a circumstance which tends to make the mortality in the merchant marine seem much lower than it really is, and to elude accurate statistics on this point. A merchant seaman who falls seriously ill at sea is put on shore as soon as an opportunity offers, being left behind at some hospital often to die; and at any rate he is thus lost sight of. In this manner certainly a large number of deaths in the mercantile marine escape registration.

Although, as we have seen, one cannot draw any conclusion regarding the health of the whole of the population afloat, from that of the navy, yet the Statistical Reports of the Health of the Navy are of considerable interest not only in themselves, but also with regard to our present subject. According to the latest one,[1] for the year 1874, the *death-rate* in the British navy was 9·4 per 1,000, the number of men estimated to be constantly serving during the year being 44,530, of whom 50·32 per cent. were between the ages of 15 and 25; 34·03 between 25 and 35; 12·53 between 35 and 45, and 3·11 per cent. above 45 years of age. The latest Report of the Health of the British Army for the year 1873 shows a death-rate of 12·26–8·28 per 1,000, for the troops serving in the United Kingdom, 16·25 per 1,000 for those at stations abroad. The death-rate in the navy, therefore appears to be more favourable than in the army. In explanation of this we must remember that at unhealthy foreign stations the mortality is, as a rule, much lower on board a man-of-war than amongst the troops on land.

Nowhere is the influence of hygienic improvements in lowering the death-rate more strikingly shown than in the navy and army. In the year 1779 the death-rate in the former was 123, in 1811 it had already declined to 31, in 1836 to 13, and in 1874, as we have seen, to 9·4 per 1,000 men of actual strength.

The rate of *morbility*, including injuries, was, in 1874, 1196·6 per 1,000; 39·18 per 1,000 were invalided. In the army only 1036 per 1,000—759·2 at home, 1314·7 at stations abroad—were admitted to hospital, and 37·3 per 1,000 were invalided—25·26 at home, 49·35 at foreign stations.

In the *Russian* navy the death-rate in 1860 was still as high as 19 per 1,000, whilst on the contrary the rate of admissions into hospital was, if the figures cited by Oesterlen in his "Medical Statistics" be correct, only 509 per 1,000, or less than half of that in the British navy as late as 1874. I shall not attempt to inquire into the cause of this astonishing discrepancy.

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[1] This was written in 1875.

Of special interest for our present subject is the proportion *pulmonary consumption* bears to the total causes of mortality and morbility among the seafaring population. In 1874 phthisis caused but 4·1 per 1,000 of the total cases of admissions in the British navy, or something like 3·4 per 1,000 men of actual strength. Like the state of health in general, this compares very favourably with former periods; so in the years 1830–36 the rate of admissions for phthisis, including cases of hæmoptysis, was nearly as high again, viz. 7·2 in 1,000 men of actual strength; the death-rate from phthisis during the last-named period was 1·7 per 1,000 men. Among the English land-population the latter rate was in 1838–41 almost as high again as in the navy, viz. 3 in 1000. In the Russian navy as late as the year 1860, the rate of admissions for phthisis was about 9 in 1,000; that of deaths from this disease as high as nearly 6 in 1,000 men.

It appears from these figures that phthisis was a far more fatal disease in the Russian than in the British navy. In the one the proportion of deaths to admissions from phthisis was as 25 to 100, in the other as 66 to 100.

In the British merchant marine nearly 3,000 deaths were registered from 1838–48. This small number, by the way, shows how extremely defective that registration of deaths must have been. For, taking the number of men then employed in the merchant marine at 172,000—in 1873 it had increased to 202,239—this would give an annual death-rate of only 1·7 in 1,000. In 1836 the death-rate in the navy, the health of which was always considered to be far better than that of the merchant marine, was, as we have seen, 13 in 1,000. The proportion of deaths from phthisis to the total of 3,000 deaths in the merchant marine was 40 in 1,000, whilst among the land population in England in 1838–41 that rate was 172, and as late as 1859 was 113·8 in every 1,000 deaths from all causes.

Here I may remark that, at least on the Continent, where there is not yet anything like such a national registration of deaths and their causes as in the United Kingdom, the mortality from phthisis is commonly rated far too high, being, in the absence of general statistics, calculated from hospital reports and the like. Thus it happens that phthisis is supposed to be the cause of death in from every seventh up to even every third case. I believe this erroneous estimate to be principally due to the fact that a most important class of deaths—those in infancy and childhood, up to the fifth year of life—rarely comes under observation in general hospital practice; whilst, on the other hand, that class of the community in which consumption reaps her richest harvest, viz., the lowest and poorest class, is there in a large majority.

Now, the proportion of the mortality from phthisis in the merchant marine to that among the land population will be still more strikingly in favour of the former, if we follow the correct plan, and only take into consideration the period of age that corresponds to that of active sea-service, instead of taking the total land population. First, however, I have to state that the mortality from phthisis among the English land-population has been decreasing pretty steadily and even considerably from the time at which those statistics were taken down to the year 1859. Thus, as we have seen, the rate in 1838-41 was 172 in every 1,000 deaths from all causes, in 1858—59 it was only 113·7, *i.e.* a decrease by about 66 per cent. But even when we take this later and far more favourable rate and compare the mortality from phthisis at corresponding ages in the merchant marine and the land-population in England, say the period from the fifteenth up to the forty-fifth year of life, we get a proportion of 40 deaths from consumption in every 1,000 from all causes among merchant seamen in 1838—48, to 418·4 among the land-population, *i.e.*, the proportion is more than ten times greater on land than at sea, and if we take the death-rate at similar ages it is about sixteen times as great. In fact, whilst at sea I have never myself seen a single case of phthisis in a merchant seaman, although I have been in medical charge, on and off, of over 120 of them.

Without, therefore, ascribing to sea-life any specific immunity from phthisis, yet I think it has an unmistakable *influence in preventing consumption.* How far its healing powers in this direction go will be shown later on.

Very different results have been arrived at by M. Rochard, who believes that sea life, particularly within the tropics, is peculiarly apt to produce phthisis, much more so than is the case with land life in our climates. To these assertions, however, M. Garnier strongly objects, on the ground that at the seaman's hospitals at Toulon, Brest, Cherbourg, Lorienhand, Rochefort, during a number of years only 9·4 per cent. of the deaths were from phthisis, while at the same time the proportion among the general population of those places was over 20 per cent.

(2.) *The Health of Emigrants and Private Passengers on long Sea-voyages.*—According to official statistics, in the course of about five years, up to September 30th 1875, 61,312 emigrants were sent from Great Britain to New Zealand. Of these 43,406 were adults, 15,287 children from one to twelve years of age, and 2,629 infants under twelve months. Of the adults 150 died during the passage, *i.e.*, 3·5 in 1,000 which would give an annual death-rate of about 14·0 in 1,000. Considering that emigrants are mostly in the prime of life and in good health when setting out for a new world, this death-rate appears a rather high one; and that of the children and infants is still higher. Of the former, 1,094, *i.e.*, nearly 72 in 1,000, died during the voyage, which lasted about three months, so that the annual death-rate thus amounted to about 285 in 1,000; of the infants 502, or 191 in 1,000 died during the passage, being equal to an annual mortality of 164 in 1,000!

These statistics, which chiefly relate to excellent new ships under special government superintendence, speak volumes against the crowding together of emigrants, and in favour of the urgent necessity of further sanitary and particularly dietetic improvements.

It would not be difficult to get statistics also of the *morbility* in emigrant ships, their medical superintendents, being not only, as a rule, qualified practitioners, but being also under direct government control. I very much doubt, however, whether any such statistics have yet been collected. Certainly there are none whatever on the health of *private passengers* on long sea-voyages. I am therefore, in this respect, as in most others throughout these papers, confined to my own observations, which for statistical purposes are necessarily by no means sufficiently extensive to allow general conclusions to be drawn from them. They relate moreover to a private passenger sailing ship of the very best class, but with a rather abnormal class of passengers, the latter being, at least on the voyage to Australia, mostly invalids. My voyage to South America I leave out of consideration at present, because I should not reckon a sea-voyage among the long ones which all in all, there and back, was only something over three months and a half duration, and in which the periods of uninterrupted sea-life lasted only from a fortnight to three weeks at the most.

On my last voyage, then, round the world, the mortality was equal to 30·8 per 1,000, which as all the four deaths occurred during the voyage to Australia, and none on the homeward voyage, would amount to a yearly death-rate of about 138·6 per 1,000 for that first part of the voyage. Of those four deaths three were from consumption. The only case of death that occurred among the crew was that of a midshipman, who was drowned by falling overboard during a strong gale. Thus no death from disease contracted on board occurred during the whole of that long voyage.

As regards the morbility in my last ship, about 80 per cent. of the total number of persons she carried came under medical care. These numbers, however, do not represent the rate of morbility, which was very much much higher, a large majority of the 80 per cent. of persons coming more than once under medical treatment for different diseases.

Affections of the Respiratory Organs, together with *common colds*, I have reserved until now, because their frequency or non-frequency bear pretty directly upon the principal subject of this chapter, viz., the question of the value of sea-voyages in the treatment of consumption. I have somewhere read the remarkable statement that at sea one does not catch cold, and that it is only on coming ashore after a long sea-voyage that sailors and passengers are liable to it. Now my experience shows that so far from primary cases of catarrhal affections of the respiratory organs on a long sea-voyage being absent, they take on the contrary the third place in frequency in my pathological list (see Part iv), disorders of the digestive system occupying the first, and those of the skin the second place. And this is the case, even if we exclude cases where pulmonary disease was present at the commencement of the voyage, and where a peculiar liability to respiratory affections therefore existed. The "common cold" showed a remarkable preference for seamen; acute bronchitis for children, acute catarrh of the larynx was observed exclusively among the former. It is also a remarkable fact that scarcely any *chronic* affections of the respiratory organs amongst the seamen came under my notice.

To sum up my experience on the state of health on long sea-voyages, I cannot but say that the *morbility* appears a *remarkably high one.* From this one might be inclined to conclude that little is to be expected from long sea-voyages as a cure for consumption. The same objection has also been made with regard to those thermo-climatic resorts where the prevalence of phthisis and zymotic diseases, including infantile diarrhœa, indicates the hygienic condition of the place to be more or less unsatisfactory. But one cannot draw from the mortality and the morbility of a native population rigid conclusions as to effect, favourable or otherwise, which a temporary residence at that place for a curative purpose will have on the invalid. The latter is expected to regulate his life strictly according to hygienic rules with regard to *régime,* food, dwelling-place, air, &c. Thus it is possible more or less to avoid the sanitary drawbacks, and at the same time to get the full benefit of the climatic advantages of a place. For it is unsanitary conditions, and not the warm climate, as some have asserted, which produces phthisis and other diseases prevalent among the native population. The climate, it is true, in consequence of its high temperature is apt to give that disease a more infectious and septic character, which also manifests itself in a good many other diseases in warm climates.

At sea it is much more difficult to avoid sanitary drawbacks in the way indicated than at a climatic resort on land.

It is not, however, in regard to hygiene alone that an invalid or a new comer is in general more favourably circumstanced than native residents. He has also a climatic advantage; for besides the direct benefit he may derive by the change of climate, he possesses a certain immunity from the diseases to which the inhabitants are liable. Thus it has been found that a person coming from high into low tropical latitudes, where catarrhal affections of the respiratory organs, for instance, are very prevalent, is much less subject to them than the natives. In speaking of the European residents in the French colony of Senegambia, Dutroulan says:—"Les phlegmasies aiguës des bronches sont excessivement rares, malgré une météorologie dont les écarts et les exagérations dépassent tout ce qu'on rencontre dans nos autres colonies." In British Gambia the morbility and mortality from diseases of the respiratory system among the colonial troops, exclusively natives of Africa, there being no European troops there, are far higher than at any place, either at home or abroad, where British troops are stationed. Dutroulan's remark is also confirmed by a comparison of the rate of morbility from those diseases, as shown by official statistics among the European and colonial troops at stations where both live together. With only one exception—Ceylon, where the proportion is reversed—the rate is considerably lower among the European than the colonial troops.

Quite the contrary relation appears to obtain in regard to the morbility and mortality from zymotic diseases of natives and new comers respectively. New comers, as is well known, are most liable to be attacked by yellow fever, malaria, dysentery, &c., at places where those diseases are endemic, whilst the natives with a little sanitary precaution, keep comparatively free from them. In the same way the enteric fever of Munich is most dangerous to new comers.

3. *On the Value of Sea-voyages in the Treatment of Consumption.*

The physical (chap. i.), physiological and therapeutical (chap. v.) characters of sea-climates; the hygiene (chap. ii.), the physiology and pathology of sea-life (chap. iv.), its mortality and morbility statistics (chap. v. 1 and 2) having been given, we have now, I think, got a pretty broad basis from which to approach the question of the value of sea-voyages in the treatment of consumption.

The first and most important point, then, we have to examine is the *therapeutical character of long sea-voyages*, particularly as compared with the action of the sea-climate at one and the same place, on *terra firma*. It is a common belief, at least among the non-professional public, that their principal therapeutical value lies as much in the invalid avoiding the winter of the northern hemisphere and enjoying an equable warm climate, as in his being in the constant enjoyment of pure sea-air. With regard to the first supposition, the invalid is sure to be deceived, and the same will more or less be the case also with regard to the second one, inasmuch as he not only has to breathe the stuffy air of a small cabin at night, but may also be confined to it during the daytime in case he is not strong enough to face every sort of weather in the open air, or is altogether laid up.

As has been shown in the first chapter, the climatic changes on a long sea-voyage, in particular that to Australia, are very great indeed, greater than any observed in our climate, at least within so short a time. It takes only a few weeks to pass from the prostrating heat of the tropics to the freezing cold and chilling gales of the southern oceans, where the appearance of icebergs may at any time complete the impression of veritable winter, and *vice versâ*. Thus it is clear that to expect equability of climate and perpetual summer on such a voyage is an illusion which may prove fatal to an invalid. It cannot, therefore, be to those circumstances that the beneficial action of a sea-voyage as a therapeutical agent is due. It is, on the contrary, the *great diversity and rapid change of climate that constitute the therapeutical character of sea-voyages* by acting as a potent *stimulus* to the whole system, as well as *hardening* the invalid's constitution against every sort of climatic vicissitudes.

This, in my opinion, is the principal point to be considered by a medical adviser in weighing the *pros* and *cons* of this remedy.

Of what avail is the pure sea air outside to an invalid who dares not face it, being obliged to retire into the close atmosphere of his cabin before any of those climatic vicissitudes so frequent and varied on a long sea-voyage, heat or cold, a sudden change of the weather, a long-continued rain, a strong gale, rough sea, &c., or if he is altogether confined to his bed by a fresh cold he has caught by exposing himself to one of them? The first and principal condition, therefore, for sending a patient to sea for his health is *that he have strength enough left* to face those climatic vicissitudes; that his power of resistance have not, by long and severe disease, or by the manner he has hitherto been nursed, been reduced to such a degree as to render him too tender and weakly to struggle successfully against them. Much, however, can be done in the way of a rational systematic *régime*, at sea as well as on land, towards making even a very weak constitution more fit for this struggle.

I had a regular system of gradually preparing for it the invalids under my care at sea. Some of them had until then been under the care of fidgety mothers or aunts, and at first their beliefs were utterly hostile to my system, and they preferred to shut themselves up against the open enemy of a cold wind, thereby falling into the hands of a more insidious foe, a stuffy polluted air. I must say that I found them more docile and reasonable on this point, than in regard to their general mode of life, which only too often was contrary to the principles of a rational *régime*.

If in this way an invalid gets to stand every sort of climate and weather in the open sea-air, as well as sudden changes from one to the other, his constitution will be not only directly benefited, but he is likely also to become hardy enough to stand thereafter the vicissitudes of his native climate.

After what has been said, I need not further detail the indications for sending consumptive patients to sea for their health; they will moreover result, by way of exclusion, from an enumeration of the principal contra-indications.

I should like to correct here a current opinion that the quiet of sea-life is a great reason for sending patients to sea for their health. I can only say that to one not yet initiated into sea-life, this will not prove a particularly idyllic task, nor one to be accomplished in a short time; he will find a good deal to excite himself about, if he have not a perfect mastery over himself in the sense of the great Horatian principle *nil admirari*. In fact, it is much more easy to find quiet on *terra firma* than at sea The very difference of the two elements speaks for it.

I do not, however, mention this as being a disadvantage of sea-life; on the contrary, I consider it far better for one who wants rest from overwork, business-worry, trouble, and anxiety of any kind, to have his thoughts directed into other channels, than to be left to his former mental occupations, which have already engaged him so long and so closely as to break down his health.

The principal *contra-indications* to sending a consumptive patient on a sea-voyage for his health are:—

1. *Extreme debility*, particularly if combined with an *advanced condition of the local disease.* It is a great risk and, therefore, it may be downright cruel to send such patients away as a last resort, the probability being that their sufferings in more than one way will be increased and death accelerated. Before taking that step I should thoroughly recommend a cautious trial of the home climatic treatment, as detailed in my paper, *Principles of the Climatic Treatment of Consumption.* This can be carefully watched and at any time discontinued. If the season be too rough or the patient too weak, then let him die quietly at home.

2. A patient should not be sent to sea who is not quite free from *fever*, or those hectic rises of the evening temperature indicating an active progress of the disease, constitutional and local. There is great risk of the fever increasing, and from an intermittent becoming a remittent or continued one, as the temperature of the air rises to tropical heat. One of my patients died in this way even before the line was reached. In the case of another who died later on, such an increase of the fever could be traced from the time of entering the tropics. Generally speaking, any urgent or active symptoms ought to be removed before sending a patient to sea.

3. A pronounced *disposition to* hæmorrhage, in particular hæmoptysis, forms another contra-indication. This is not so much in view of sea-sickness—for much as I have seen of the latter both in healthy people and invalids, I never have met with a case of hæmorrhage caused by it—as in view of the hot, sultry weather of the tropics, which, as we have seen in the fourth chapter, may cause a regular epidemic of hæmorrhage. This warning I would address particularly to invalids of more advanced age, whose blood-vessels, often up to the very largest ones, are more or less in a state of sclerotic degeneration. In the two most serious cases of hæmoptysis that came under my notice at sea, the one person who died was nearly fifty, the other over thirty years of age. In particular, careful examination of the condition of the

arteries and the heart should therefore be made before sending a patient of somewhat advanced age to sea.

4. A difficult point to prognosticate is the disposition of an invalid *to sea-sickness,* if this has not been already proved by a previous voyage of some length. A short trip like that across the Channel decides nothing even if the person has been violently sea sick. I do not know how one could foretell with anything like precision whether that state of misery would last for a short or long time were the voyage to last some weeks or months. I may be allowed to repeat here Mr. Darwin's words: "If a person suffer much from sea-sickness, let him weigh it heavily in the balance. I speak from experience: it is no trifling evil, cured in a week." Invalids, however, as has been remarked in the chapter on sea-sickness, do not, on the whole, suffer much from it.

5. A similar difficulty to that of prognosticating the degree and duration of sea-sickness an invalid will have to undergo exists as to how sea-life will agree with his digestion. A weak stomach certainly is no recommendation for a long sea-voyage. I have, however, seen a stomach, previously very weak and dainty, after sea-sickness was over, master food which it could not have done at home. Cookery on board English vessels is plain, not to say coarse, or if there be any aspirations after something higher, it falls more or less short of the "fine arts." At any rate, most of those "nice little things," as a friend of mine longing for them endearingly used to call them, and which are equally dear to the gourmand and to the invalid, are not to be got at sea.

It now only remains for me to give an account of my experience on the effect sea-life had on the consumptive invalids that, twenty-six in number, were under my observation during my last voyage round the world.

After the longer or shorter time—on an average we may say a fortnight—it takes to get over sea-sickness and the period of acclimatisation to sea-life, the passengers, healthy and consumptive, appear to be reviving in body as well as in mind. This change to the better is the more striking the more a person has been down in either respect, either at embarking or only in consequence of the miseries of sea-sickness. The sallow, pale and sunken-in face is after some weeks fresher and fuller-looking; the hectic expression of the whole frame and habit gives place to a more healthy, elastic, and vigorous one. The animal spirits too revive; a feeling of buoyancy and delight takes the place of the former dejection. Life is felt to be a pleasure instead of a burden. Even the termagant temper not unfrequently met with among our class of invalids cannot resist the charms and the enlivening effects of the perfect climate, within the trade-wind, before which by that time the ship will be flying southward.

But soon the heat becomes trying to the strong as well as to the weak. The effects of the tropical climate, in particular of the calm weather, on the general condition—prostration—on the digestive system—indigestion—and the circulatory system—congestions, hæmorrhages—have been fully described in the fourth chapter. I was told by several of my consumptive patients on board that they seriously thought of dying under that climatic trial. One gentleman in fact died while still on this side of the equator. In the two other cases of consumption that ended fatally on the outward voyage their getting worse distinctly dated from the beginning of the hot tropical weather. One man very nearly died during it from a series of the most profuse hæmoptoic attacks attacks I have ever seen. Life in fact seemed to be extinct, when he received new blood and with it new life by a direct transfusion of blood from the carotid of a lamb into a vein of his forearm.

I will not, however, dwell any longer on incidents of the voyage, but continue to follow the general effect of the voyage on the constitution of our consumptive passenger. Supposing then he has not been thrown back by some climatic influence he was too weak to withstand, or to which he exposed himself without the necessary caution, by an anti-hygienic mode of life to which invalids as soon as they are a little better are easily tempted, or by the strongly progressive tendency of his disease—in short, supposing things to stand as favourably as can well be expected, yet the constitutional improvement is checked after a certain time, the state of our invalid's constitution remains now stationary for a certain period and then a retrogressive tendency is observed to set in. The individuals themselves are, as a rule, well aware of those different stages—*the progressive, the stationary,* and *the retrogressive.* They are, moreover, written on their very countenances.

This is a point well to be noticed, and one quite contrary to the notion one frequently meets with, viz., that the longer a sea-voyage the more efficacious it must be. The same rule, however, applies to this as to other therapeutical agents. The same changes may be observed in patients sent to some climatic resort on land; the same in the action of drugs. For instance, a certain drug may have a most striking effect at first in some disorder of the stomach or of the bowels; but after a certain time there comes a check, and still further on the ground gained may gradually be lost again. Another remedy is resorted to which, although it may act on the same principle, yet seems to take quite a fresh effect. Another instance is that of cod-liver oil, which often proves of great benefit for a certain time, when it is refused, the organism being as it were saturated with it.

Change is the great thing for keeping the organism in good and vigorous condition and for restoring health to the sick. It is therefore not only to their particular therapeutical character, as above defined, that sea-voyages owe their value as a remedy for consumption, but also to the thorough change in climatic, hygienic, and social respects which a long sea-voyage, say to the antipodes, involves. For this reason also the very change from sea to land life has a similar beneficial effect.

In this case the reviving and refreshing effect on the healthy as well as the sick body makes itself felt even more quickly, as one has not first to get over the lowering effect of sea-sickness. The popular belief of the beneficial action of a sea-voyage in some cases "coming out" only after it is over is, therefore, not without foundation. I should thus interpret it: that whilst the change from land to sea had little apparent effect at the time, this becomes evident when it is doubled, as it were, by the reverse change.

To return to the different *changes in the action of sea-voyages on the constitution,* one will ask after what time the acme of this therapeutical action at the end of the first progressive stage is reached, *how long*, consequently, *a therapeutical sea-voyage is to last.* The answer, of course, cannot be given in precise figures, as these, necessarily, vary considerably, not only according to the individual case, but also to external physical circumstances. I should, however, as an average, fix the time it is desirable such a voyage should last at about two months. Beyond this period, generally, no further benefit appears to be derived from uninterrupted sea-life by an invalid, and when it lasts much longer— three and as long as four months, as I myself have seen it—a retrograde effect obtains even with healthy people.

I am sorry space does not permit here to reproduce a table specifying sex, age, origin, and character of the disease, stage of the pulmonary affection, effects of the voyage on the local and general disease in each of my twenty-six cases, and further illustrating them in the column "remarks." I therefore must confine myself to the following summary: four of my cases were females, the rest males. Their ages were between 5 years—a boy born in Australia with strong hereditary disposition—and 49 years; the average age was about 26½ years. Eleven cases were of catarrhal, fifteen of tubercular origin,—terms which will be fully explained in a separate paper—" Principles of the Climatic Treatment of Consumption," and of the latter with marked hereditary disposition.

As regards the stages of the local disease, as I found them at the first examination, I have to premise my definition of them. By the first stage—*phthisis incipiens*—I understand dulness confined to the apex of the lung; by the second, dulness reaching downwards over the second rib in the front, or the spine of the scapula at the back, or both of them at the same time. The third change is characterised by signs of excavation besides those of infiltration or induration. I have found those definitions the most congruent to clinical experience. Of my twenty-six cases, then, in nine the affection was in the first stage; seven of them were unilateral, two bilateral. Bilateral affection of the first stage on the one, of the second on the other side, was represented in four cases, and in the same number also bilateral affection of the first stage on the one, of the third on the other side. There were two cases of unilateral, one of bilateral affection of the second stage; three cases of bilateral affection of the second stage on the one, of the third on the other side. Lastly, there was only one case—of catarrhal origin—of unilateral affection of the third stage, two of bilateral affection of the same.

The results of the sea-voyage were (1) on the constitution: fourteen cases got better; four worse; two died; in five there was no material change one way or other, to be noticed. (2) on the local disease; in five cases it got better; in six it remained stationary; in two better on the one side, worse on the other; in thirteen cases it got worse.

The only statistics besides these of results of sea-voyages, in the treatment of consumption which have come under my knowledge, are those collected by Dr. Theodore Williams. From the following extracts from an extensive table of his, it will be seen that the results obtained by Drs. Williams, father and son, compare most favourably, not only with those obtained at even the most famous climatic health-resorts, on *terra firma*, on the Mediterranean basin, and above all others in Egypt, but also with the results I have just given.[1] With the latter they seem to be so much at variance as to require some comment. First of all, these eighteen sea-voyage cases were *selected* for this plan of treatment by men of the highest authority in this branch of pathology, whilst of the totality of my own cases I got the impression that they had been sent to sea *at random*. Dr. H. Weber also, as he kindly informs me, has seen good results in the cases he *selected* for this kind of climatic treatment. 2. Those statistics are based on too small a number of cases, even smaller than my own (eighteen against twenty-six cases). Neither of them can be considered large enough to draw general conclusions from. 3. A large majority of Drs. Williams's cases—72·22 per cent.—were of the first stage only, a circumstance which testifies to the humane cautiousness of the medical advisers. 4. Whilst

	Results.			Number of patients.	Number of sea-voyages or winters.
	Improved.	Stationary.	Worse.		
Sea-voyages	89 %	5·5 %	5·5 %	18	45
At Stations on the Mediterranean Basin, including Egypt	61 %	21·8 %	17·2 %	172	255

of the 172 patients wintering at stations on the Mediterranean or in Egypt, each spent there on an average not quite 1·5 winters, the average for the invalid afloat has 2·5 voyages, mostly to Australia and back, which amounts to considerably more than even the same number of winters, such a voyage not only including our winter, but the greater part of the year.

By these remarks I do not intend to detract in any way from the value of sea-voyages as a therapeutical agent, nor from their superiority in this respect over the thermo-climatic treatment on *terra firma*, as shown by Dr. Williams's statistics. Their superiority is the more remarkable as the climatic treatment on *terra firma* has several important advantages over that on board ship, particularly in hygienic and dietetic respects.

A ship cannot be so well ventilated as a house; so during the night-time at least the invalid will enjoy, on the whole, a purer air on land than sea. During the day also, he can have as much fresh air on land as at sea, and, if he is at the sea-side, where most of the thermo-climatic health-resorts are situated, of sea-air too. On *terra firma* one always, at least in the south, has those fresh provisions, especially vegetables, which one is either entirely deprived of at sea, or can only get in the shape of preserves. Here also the daily life and exercise can be diversified as much as is desirable. On the other hand he may have a more quiet and retired life, if he desires it, on *terra firma* than on board ship. On board ship one cannot help being in daily company with people one would fain avoid the sight of if he were on shore—no trifling point considering the irritability of temper common with consumptive invalids. A long sea-voyage cannot, like the thermo-climatic treatment on shore, be broken off whenever there is occasion for doing so. What is it then that nevertheless gives sea-voyages their therapeutical superiority? The explanation is to be found in the very difference of their therapeutical characters. Whilst the thermo-climatic treatment has only an alleviating symptomatic effect, as is shown more fully in my paper—"Principles of the Climatic Treatment of Consumption—" the effect of the thalasso-climatic treatment meets the *indicatio morbi* it is at the same time a strengthening and a hardening one.

Taken altogether sea-voyages are, and no doubt will be, more and more generally appreciated as *a most valuable agent in the treatment of consumption, if only the cases are judiciously selected and the invalids themselves keep a strict régime.*

An invalid who has an open eye and heart for things beyond his own pale, and who, in particular, is fond of the sea in its varied grandeur, will not fail to combine on a voyage to the Antipodes *utile cum dulce,* gaining health, new knowledge, and pleasure at the same time, and by leaving all trouble and care behind him and entering with heart and soul into the new condition of life, he will confute that other Horatian dictum—*Cœlum non animum mutant qui trans mare currunt.*